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Economic Impact Analysis for the Mandatory Reporting of Greenhouse Gas Emissions F-Gases: Subparts I, L, OO, SS

Draft Report

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SECTION 1
INTRODUCTION AND BACKGROUND

1.1 Background

On December 26, 2007, President Bush signed the FY2008 Consolidated Appropriations Act which authorized funding for EPA to "develop and publish a draft rule not later than 9 months after the date of enactment of this Act, and a final rule not later than 18 months after the date of enactment of this Act, to require mandatory reporting of GHG emissions above appropriate thresholds in all sectors of the economy of the United States." (Consolidated Appropriations Act, 2008, Pub. L. No.110-161, 121 Stat 1844, 2128 (2008)). An accompanying joint explanatory statement directed EPA to "use its existing authority under the Clean Air Act" to develop a mandatory GHG reporting rule.

The Final Mandatory Reporting of Greenhouse Gases Rule was signed on September 22, 2009 by Administrator Lisa Jackson; and published in the Federal Register on October 30, 2009. The Final MRR which is effective on December 29, 2009 included reporting of GHGs from the facilities and suppliers that EPA determined appropriately responded to the direction in the 2008 Consolidated Appropriations Act[1]. These source categories capture approximately 85 percent of U.S. GHG emissions through reporting by direct emitters as well as suppliers of fossil fuels and industrial gases.

In the April 2009 proposed mandatory GHG reporting rule, the electronics, fluorinated GHG production, and use of electrical equipment source categories were included as subparts I, L, and DD. In addition, EPA requested comment on requiring reporting under subpart OO of the quantities of fluorinated GHGs imported and exported inside pre-charged equipment and foams. EPA received numerous comments on these subparts related to reporting costs and technical feasibility of implementing subparts I and L; requests for clarification of how "facility" should be interpreted in subpart DD, and comments both in favor and opposed to a requirement to report imports of F-GHGs contained in imported and exported pre-charged equipment and closed-cell foams.

[1] Consolidated Appropriations Act, 2008, Public Law 110–161, 121 Stat. 1844, 2128.

EPA recognized the concerns raised by stakeholders, and decided not to finalize subparts I, L, and DD with the Final MRR, but instead to re-propose significant pieces of these subparts. This supplemental proposal incorporates a number of changes including, but not limited to, different methodologies that provide improved emissions coverage at a lower cost burden to facilities than would have been covered under the initial proposal. In addition, EPA is proposing requirements to report emissions from manufacture of electrical equipment and to report the quantities of fluorinated GHGs imported and exported inside pre-charged equipment and foams.

EPA believes the monitoring approaches proposed in this action, which combine direct measurement and facility-specific calculations, effectively balance accuracy and costs, and that they are warranted even though the rule does not contain any emissions reduction requirements. As stated in the Final Rule, the data collected by the rule are expected to be used in analyzing and developing a range of potential CAA GHG policies and programs. A consistent and accurate data set is crucial to serve this intended purpose.

1.2 Proposed Rule: F-Gas Subparts

This proposal requires reporting of fluorinated greenhouse gas (F-GHG) emissions from electronics manufacturing, production of fluorinated gases, and use of electrical equipment. EPA is also proposing to require such reporting from manufacturers of electrical equipment, import and export of pre-charged equipment, and closed cell foams. These F-GHG source categories are covered under Subparts I, L, OO, and SS of the rule. This section provides a brief introduction to the industries covered by each subpart and details which subparts were included in the initial proposal and which subparts are new additions to the original MRR.

1.2.1 Subpart I: Electronics Manufacturing

Electronics manufacturing includes but is not limited to the manufacturing of semiconductors, liquid crystal displays (LCD), microelectromechanical systems (MEMs), and photovoltaic (PV) cells. The electronics industry uses multiple long-lived F-GHGs such as perfluorocarbons (PFCs), Hydrofluorocarbons (HFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3), as well as nitrous oxide (N_2O). The proposed rule applies to electronics manufacturing facilities that emit GHGs from electronics manufacturing processes such as plasma etching, chemical vapor deposition, chamber cleaning, and heat transfer fluid use.

Subpart I was included in the initial MRR proposal but omitted from the final rule. EPA received comments from entities within the covered industries regarding the requirements put

forth in the initial proposal. EPA took these comments into consideration and is proposing a revised version of the MRR for entities covered under this subpart.

1.2.2 Subpart L:Fluorinated Gas Production

The fluorinated gas production source category consists of facilities that produce fluorinated gases. Under the proposed rule, these facilities would be required to report their fluorinated GHG emissions from fluorinated gas production, transformation, and destruction, as well as combustion-related CO_2, CH_4, and nitrous oxide (N_2O) emissions from stationary fuel combustion. Fluorinated gases include fluorinated GHGs (HFCs, PFCs, SF6, NF3, HFEs, etc.), CFCs, and HCFCs. However, emissions of HFC-23 from HCFC-22 production are addressed under subpart O and are therefore excluded from this subpart. Similarly, emissions of CFCs and HCFCs are addressed under the regulations implementing Title VI of the Clean Air Act and are therefore excluded from this subpart.

Like Subpart I, Subpart L was included in the initial MRR proposal but omitted from the final rule. After receiving comments on the proposed regulation in the initial proposal, EPA has modified the rule with respect to entities under this subpart and is proposing the revised version

1.2.3 Subpart OO: Imports and Exports of Fluorinated GHGs in Pre-Charged Equipment and Closed-Cell Foams

The source category, importers and exporters of fluorinated GHGs contained in pre-charged equipment or closed-cell foams, consists of any entity that is importing or exporting pre-charged equipment that contains a fluorinated GHG such as air-conditioning and refrigeration equipment. This subpart also covers any entity that imports or exports closed-cell foams that contain a fluorinated GHG.

Today's proposal introduces Subpart OO as a new addition to the MRR. This source category was not included in the initial rule.

1.2.4 Subpart SS: Electrical Equipment Manufacture or Refurbishment and Manufacturing of Electrical Components

The electrical equipment manufacturing category includes facilities that manufacture gas-insulated substations, circuit breakers, other switchgear, gas-insulated lines, or power transformers containing sulfur-hexafluoride (SF_6) or perfluorocarbons (PFCs).

This is the initial proposal for Subpart SS. This source category was not covered under the initial MRR.

1.3 Economic Impact Analysis for F-Gas Subparts

As part of the regulatory process of proposing these rules, EPA is required to develop an economic impact analysis (EIA). This report documents the EIA methods and results and proceeds as follows: Section 2 describes the current regulatory context into which the new proposals will be integrated. Section 3 explains the development process for each of the four subparts, and Section 4 details the individual cost analyses methodology used to evaluate each regulation. Section 5 presents the results of the economic impact analysis. A review of executive orders is provided in Section 6, which is followed by a brief EIA summary and conclusion in Section 7.

SECTION 2
REGULATORY BACKGROUND

The intent of this rule is to collect accurate and timely GHG emissions data that can be used to inform future policies. Although the mandatory GHG rule is unique, EPA carefully considered other federal and state programs during development of the rule. The reporting program will supplement rather than duplicate other U.S. government GHG programs. We outline EPA's overall rulemaking approach, sources considered, and summarize our review of GHG monitoring protocols below. For example, the monitoring and GHG calculation methodologies for many source categories are the same as, or similar to, the methodologies contained in state reporting programs. The remainder of the section provides an overview of related existing programs and discusses their relevance in the development of this rule.

2.1 EPA's Overall Rulemaking Approach

The mandatory reporting program will provide comprehensive and accurate data which will inform future climate change policies. Potential future climate policies include research and development initiatives, economic incentives, new or expanded voluntary programs, adaptation strategies, emission standards, a carbon tax, or a cap-and-trade program. Because we do not know at this time the specific policies that will be adopted, the data reported through the mandatory reporting system should be of sufficient quality to support a range of approaches.

To these ends, we identified the following goals of the mandatory reporting system:

- Obtain data that is of sufficient quality that it can be used to support a range of future climate change policies and regulations.
- Balance the rule coverage to maximize the amount of emissions reported while excluding small emitters.
- Create reporting requirements that are consistent with existing GHG reporting programs by using existing GHG emission estimation and reporting methodologies to reduce reporting burden, where feasible.

2.1.1 Stakeholder Outreach to Identify Reporting Issues

Early in the development process, we conducted a proactive communications outreach program to inform the public about the rule development effort. We solicited input and

maintained an open door policy for those interested in discussing the rulemaking. Since January 2008, EPA staff has held more than 100 meetings with stakeholders, including the following:

- trade associations and firms in potentially affected industries/sectors;
- state, local, and tribal environmental control agencies and regional air quality planning organizations;
- state and regional organizations already involved in GHG emissions reporting, such as TCR, CARB, and Western Climate Initiative (WCI); and
- environmental groups and other nongovernmental organizations.
- We also met with U.S. Department of Energy (DOE) and U.S. Department of Agriculture (USDA), which have programs relevant to GHG emissions.

During the meetings, we shared information about the statutory requirements and timetable for developing a rule. Stakeholders were encouraged to provide input on key issues. Examples of topics discussed included existing GHG monitoring and reporting programs and lessons learned, thresholds for reporting, schedules for reporting, scope of reporting, handling of confidential data, data verification, and the role of states in administering the program. As needed, the EPA technical workgroups followed up with these stakeholder groups on a variety of methodological, technical, and policy issues. EPA staff also provided information to tribes through conference calls with different Indian tribal working groups and organizations at EPA and through individual calls with tribal board members of TCR.

For a full list of organizations EPA met with when developing this rule please see the memo found at EPA-HQ-OAR-2008-0508-055.

On April 10, 2009 (74 FR 16448), EPA proposed the GHG reporting rule. EPA held two public hearings, and received over 16,000 written public comments. The public comment period ended on June 9, 2009.

In addition to the public hearings, EPA had an open door policy, similar to the outreach conducted during the development of the proposal. As a result, EPA met with over 4,000 people and 135 groups between proposal signature (March 10, 2009) and the close of the comment period (June 9, 2009). Details of these meetings are available in the docket (EPA-HQ-OAR-2008-0508). EPA also visited two fluorinated gas production facilities and conducted multiple meetings and conference calls with fluorinated gas producers in order to better understand the

current practices and issues associated with measuring emissions of fluorinated GHGs from fluorinated gas production facilities.

In the April 2009 proposed mandatory GHG reporting rule, the electronics, fluorinated GHG production, and use of electrical equipment source categories were included as subparts I, L, and DD. In addition, EPA requested comment on requiring reporting under subpart OO of the quantities of fluorinated GHGs imported and exported inside pre-charged equipment and foams. EPA received a number of lengthy, detailed comments regarding proposed subparts I and L, several comments regarding the definition of "facility" under subpart DD, and several comments regarding a reporting requirement for imports and exports of F-GHGs contained inside pre-charged equipment and foams. These comments, which are described in more detail in the discussions of the individual source categories below, raised concerns about the costs and technical feasibility of implementing subparts I and L as initially proposed, requested clarification of how "facility" should be interpreted under subpart DD, and both favored and opposed a requirement to report imports of F-GHGs contained in imported and exported pre-charged equipment and closed-cell foams. EPA recognized the concerns raised by stakeholders, and decided not to finalize subparts I, L, and DD with the Final MRR, but instead to re-propose significant pieces of these subparts. This proposed supplemental rule incorporates a number of changes including, but not limited to, different methodologies that provide improved emissions coverage at a lower cost burden to facilities than would have been covered under the initial proposed rule. In addition, EPA is proposing requirements to report emissions from manufacture of electrical equipment and to report the quantities of fluorinated GHGs imported and exported inside pre-charged equipment and foams. As noted earlier, stakeholders should submit comments in the context of this new proposed supplemental rule.

2.1.2 Analysis of Emissions by Sector

For each of the source categories considered in this proposal, EPA compiled information on current conditions in the category, including information about existing monitoring equipment or reporting frameworks, estimated emissions of GHGs, and estimated productive capacity or throughput. Incremental costs of measuring GHG emissions and conducting reporting activities were estimated under multiples scenarios. The cost estimates and analysis methodologies are detailed in Sections 4 and 5 of this report.

2.2 Existing Reporting Programs

In addition to the mandatory reporting program, a number of voluntary and mandatory GHG programs already exist or are being developed at the State, regional, and Federal levels. These programs have different scopes and purposes. Many focus on GHG emission reduction, whereas others are purely reporting programs. In addition to the GHG programs, other Federal emission reporting programs and emission inventories are relevant to the GHG reporting rule. Several of these programs are summarized in this section.

Since the 1990s, EPA has operated a number of non-CO2 voluntary partnership programs aimed at reducing emissions from GHGs such as methane, SF6, and PFCs. There are two sector-specific partnerships to reduce SF6 emissions: the SF6 Emission Reduction Partnership for Electric Power Systems, with over 80 participating utilities, and the SF6 Emission Reduction Partnership for the Magnesium Industry. Partners in these programs implement practices to reduce SF6 emissions and prepare corporate-wide annual inventories of SF6 emissions using protocols and reporting tools developed by EPA. There are also two partnerships focused on PFCs: The Voluntary Aluminum Industrial Partnership (VAIP) promotes technically feasible and cost-effective actions to reduce PFC emissions; industry partners track and report PFC emissions reductions. Similarly, the Semiconductor Industry Association and EPA formed a partnership to reduce PFC emissions in which a third party compiles data from participating semiconductor companies and submits an aggregate (not company-specific) annual PFC emissions report.

In developing the rule, we carefully reviewed the existing reporting programs, particularly with respect to emissions sources covered, thresholds, monitoring methods, frequency of reporting and verification. States may have, or intend to develop, reporting programs that are broader in scope or are more aggressive in implementation because those programs are either components of established reduction programs (e.g., cap and trade) or being used to design and inform measures that reduced GHGs indirectly (e.g., energy efficiency). Where possible, we built upon concepts in existing Federal and State programs in developing the mandatory GHG reporting rule. For a full summary of the reporting programs reviewed in the development of the mandatory reporting rule please see the Regulatory Impact Analysis for the Mandatory Reporting of Greenhouse Gas Emissions EPA-HQ-OAR-2008-0508.

SECTION 3
DEVELOPMENT OF SUBPARTS

The four F-Gas source categories included in this supplemental proposal are

- **Subpart I** -Electronics Manufacturing;
- **Subpart L** - Fluorinated Gas Production;
- **Subpart OO** - Imports and Exports of Fluorinated GHGs in Pre-Charged Equipment and Closed-Cell Foams; and
- **Subpart SS** - Electrical Equipment Manufacture or Refurbishment and Manufacturing of Electrical Components.

This section provides additional details about the development of these subparts (e.g., which were included in the initial proposal and which subparts are new additions to the original MRR). For each subpart, this section also provides a brief description of proposed monitoring methods; procedures for estimating missing data; as well as data reporting and recordkeeping requirements.

3.1 Subpart I – Electronics Manufacturing

3.1.1 Definition of Affected Entities

Electronics manufacturing includes, but is not limited to, the manufacture of semiconductors, liquid crystal displays (LCDs), microelectromechanical (MEMS), and photovoltaic cells (PV). The electronics industry uses multiple long-lived F-GHGs such as perfluorocarbons (PFCs), Hydrofluorocarbons (HFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3), as well as nitrous oxide (N_2O). This proposed rule would apply to electronics manufacturing facilities that emit equal to or greater than 25,000 metric tons of CO_2e per year[2] from electronics manufacturing processes such as plasma etching, chemical vapor deposition, chamber cleaning, and heat transfer fluid use.

In this action, EPA is proposing methods to estimate emissions from cleaning and etch processes for semiconductor, LCD, MEMS, and PV manufacture and also methods for estimating N_2O emissions from deposition and other manufacturing processes such as chamber cleaning. EPA is also clarifying methods for estimating emissions from heat transfer fluids. Finally, EPA is proposing methods for reporting controlled emissions from abatement systems.

[2] As discussed further below, EPA is proposing that uncontrolled emissions be used for purposes of determining whether a facility's emissions are equal to or greater than 25,000 mtCO2e.

3.1.2 Summary of Initial Proposal

The initial proposal for electronics manufacturing, EPA included the following provisions for reporting emissions from electronics manufacture: (1) a reporting threshold for semiconductors, LCDs, MEMS, and PV; (2) methods for estimating emissions from etching and cleaning; (3) methods for estimating N_2O emissions during etching and cleaning; (4) methods for verifying destruction or removal efficiency (DRE) of abatement equipment; and (5) methods for estimating emissions from heat transfer fluids. The main provisions proposed initially for reporting emissions from electronics manufacturing are briefly summarized in paragraphs below. For more detailed information on the initial proposal, see the electronics manufacturing section of EPA's proposed rule on the Mandatory Reporting of Greenhouse Gases (74 FR 16448).

In the initial proposal, a capacity-based threshold was proposed, requiring those facilities with a capacity of 1,080 m^2 silicon or greater to report their GHG emissions. The capacity based threshold of 1,080 m^2 silicon, which is equivalent to 25,000 $mtCO_2e$ using the 2006 IPCC Tier 1 default factors and assuming no abatement, was applicable to semiconductor, MEMS, and LCD manufacturers. Due to a lack of information on use and emissions of F-GHGs for PV manufacture, EPA proposed an emissions-based threshold of 25,000 $mtCO_2e$ for these facilities, in lieu of an emissions-based threshold, where possible, because EPA believes that this approach will simplify the applicability determination.

With respect to estimating emissions from chamber cleaning and etching during semiconductor manufacturing, in our initial proposal, EPA outlined two different methods; one method for the largest semiconductor facilities, and another method for other semiconductor facilities and LCD, MEMS, and PV facilities. EPA defined large semiconductor facilities as those facilities with annual capacities of greater than 10,500 m^2 silicon (equivalent to 29 out of 175 total facilities). For large semiconductor facilities EPA proposed an approach based on the IPCC Tier 3 method that required the use of company-specific data for (1) gas consumption, (2) gas utilization, (3) by-product formation, and (4) DREs for all emissions abatement processes at the facility. As EPA stated in the initial proposal, it had concluded that large semiconductor facilities were already using Tier 3 methods and/or had the necessary data readily available either in-house or from suppliers to apply the highest Tier method. For other semiconductor facilities and LCD, MEMS, and PV facilities, EPA proposed the IPCC Tier 2b approach, which provides IPCC 2b default emissions factors for process utilization, by-product formation, and site-specific DRE measurements.

In the initial proposal, EPA proposed to require facilities to estimate annual N_2O emissions using a simple mass-balance. This method assumed that all N_2O consumed is emitted (i.e. not converted or destroyed). Based on comments received on EPA's initial proposal, EPA is now proposing two methods for estimating N_2O emissions from electronics manufacturing: one for estimating N_2O emissions from chemical vapor deposition and another for estimating N_2O emissions from all other manufacturing processes such as chamber cleaning.

With respect to the use of devices to abate F-GHG emissions, the emissions estimation method EPA proposed accounted for destruction by abatement systems only if facilities verified the performance of their systems using one of two methods. In particular, EPA proposed to require that either (1) the DRE be verified by measurement using the methods described in EPA's Protocol for Measuring Destruction or Removal Efficiency of Fluorinated Greenhouse Gas Abatement Equipment in Electronics Manufacturing (EPA's DRE Protocol), or (2) purchase by the facility of abatement systems that were tested by a third party according to EPA's DRE Protocol. The proposed rule also required that facilities use the equipment within the manufacturer's specified equipment lifetime, operate the equipment within the manufacturer specific limits for the gas mix and exhaust flow rate intended for the F-GHG destruction, and maintain the equipment according to the manufacturer's guidelines. In addition, if facilities chose not to verify the performance of their abatement systems using the methods, only uncontrolled emissions could be reported.

To estimate the emissions from heat transfer fluids, in the initial proposal, EPA required that electronics manufacturers use the 2006 IPCC Tier 2 approach, which is based on a mass-balance method. As stated in the initial proposal, the 2006 IPCC Tier 2 approach uses company-specific data and accounts for differences among facilities' heat transfer fluids, leak rates, and service practices. Comments received on EPA's initial proposal, noted that the proposed method for estimating emissions from heat transfer fluids would require companies to compile a detailed inventory of all fluorinated heat transfer equipment and its nameplate capacity. Comments stated that such a mass balance approach would be overly burdensome. In evaluating these comments, EPA believes that there was some confusion regarding the intended method. As a result, EPA is not changing the broad outlines of the initial proposal, but does provide additional clarifying description of the required data elements.

3.1.3 Summary of Major Changes Since Initital Proposal

EPA received comments from approximately 10 entities on the proposed rule. Commenters generally opposed the proposed reporting requirements and stated that excessive

monitoring and reporting were required. For example, commenters asserted that they do not currently collect the data required to report using an IPCC Tier 3 approach, and that to collect such data would entail significant burden and capital costs. In most cases, commenters provided alternative approaches to each of the reporting requirements.

In response to those comments, EPA is revising its initial proposal and are proposing the following reporting provisions for electronics manufacturers: (1) a single emissions-based reporting threshold for semiconductor, LCD, MEMS, and PV facilities; (2) modified methods for estimating emissions from cleaning and etching activities for semiconductor facilities and other electronics facilities including those that manufacture LCDs, MEMS, and PV; (3) methods for estimating facility N_2O emissions; (4) clarified methods for estimating emissions from heat transfer fluids; and (5) revised methods for reporting controlled emissions from abatement equipment.

3.1.4 Selection of Reporting Threshold

Under the re-proposed rule, facilities that manufacture semiconductors, LCD, MEMS, and PV would be subject to an emissions-based threshold of 25,000 $mtCO_2e$. Consistent with other sections of the Final MRR, for the purposes of determining whether a facility emits equal to or greater than a 25,000 $mtCO_2e$, a facility must include emissions from all source categories for which methods are provided in the rule. For purposes of the threshold determination under subpart I, EPA is proposing two different methods, depending on whether the facility manufacturers semiconductors, MEMS, LCDs or PVs. It is important to note that these methods are only for determining whether a facility exceeds the threshold; methods required for monitoring and reporting emissions data are presented in sections 3.1.5 and 3.1.6 below.

To determine whether a manufacturer falls above or below the proposed 25,000 metric tons of CO_2e, EPA is proposing that semiconductor, MEMS, and LCD facilities use gas specific emission factors assuming 100% manufacturing capacity to calculate annual metric tons of emissions in CO_2 equivalents. Because we understand that heat transfer fluids are widely used within semiconductor manufacturing, EPA is proposing that semiconductor manufacturers add 10% of total clean and etch emissions at a facility to their estimate. EPA is proposing that PV facilities multiply annual fluorinated GHG purchases or consumption by the gas-appropriate 100-year GWPs, as defined in Table A-1 of Subpart A of Part 98, to calculate annual metric tons of emissions in CO_2 equivalents.

EPA is proposing to require an emissions estimating method that does not account for destruction by abatement equipment because actual emissions from facilities employing abatement equipment may exceed estimates when based on the manufacturers' rated DREs of the equipment and may therefore exceed the 25,000 metric tons CO_2e threshold without the knowledge of the facility operators. When abatement equipment is used, electronics manufacturers often estimate their emissions using the manufacturer-supplied DRE for the equipment. However, abatement equipment may fail to achieve its rated DRE either because it was not installed properly, is not being properly operated and maintained, or because the DRE value itself was incorrectly measured due to a failure to properly account for the effects of dilution.

EPA is proposing an emissions-based threshold in response to comments received on the initial proposal that stated the proposed capacity-based threshold created ambiguity. EPA believes an emissions-based threshold will simplify the applicability determination and that by applying the method for determining whether the threshold is met, a facility will be able to quickly determine whether they must report under this rule.

3.1.5 Selection of Proposed Monitoring Methods

EPA is proposing methods to monitor and estimate fluorinated GHG and N_2O emissions from semiconductor, LCD, MEMS, and PV manufacture. The proposed methods discussed below include the following:

(i) estimating emissions from cleaning and etching processes;
(ii) estimating facility N_2O emissions;
(iii) estimating emissions from heat transfer fluids; and
(iv) reporting controlled emissions from abatement systems.

The methods described and proposed in this section are for estimating emissions that would be required to be reported under this subpart. EPA proposes different methods for estimating fluorinated GHG emissions from etching and cleaning. One method applies to all semiconductor manufacturers and the other applies to LCD, MEMS, and PV manufacturers.

3.1.5.2 F-GHG Emissions Estimation Methods – Semiconductor Manufacturing

Under this proposal, all semiconductor manufacturers that have emissions equal to or greater than 25,000 $mtCO_2e$ would be required to estimate and report emissions from etching and cleaning using one of two approaches.

The first approach is based on: (1) gas consumption as calculated using the facility's purchase records, inventory, and gas-and facility-specific heel factors, (2) facility-specific methods for apportioning gas usage by process category using indicators of GHG-using activity (e.g. wafer passes), (3) emissions factors (including factors for by-products) based on refined process categories (e.g., categories with more specificity than the simpler cleaning and etching categories listed in the 2006 IPCC Guidelines), and (4) methods for reporting controlled emissions. This approach, hereinafter referred to as the "Refined Method", was developed in response to comments received in response to the initial proposal which called for using the 2006 Tier 3 method for estimating emissions from large semiconductor facilities. The Refined Method would apply to all semiconductor facilities, thereby removing the distinction between large and relatively smaller facilities.

3.1.5.3 F-GHG Emissions Estimation Methods – LCD, MEMS, and PV Manufacturing

In this action EPA is proposing to require an approach based on a slightly modified 2006 IPCC Tier 2b method which would include (1) gas consumption calculated using the facility's purchase records, inventory, and gas-and facility-specific heel factors , (2) gas consumption apportioned to 2006 IPCC Tier 2b process categories, clean and etch, (3) emissions factors consistent with 2006 IPCC Tier 2b factors, and (4) methods for reporting controlled emissions.

The main difference between the method proposed in this proposal and that in the initial proposal is the addition of a gas-and facility-specific heel factor to determine overall gas consumption. The method proposed to develop the gas-and facility-specific heel for LCD, MEMS, and PV facilities is the same as proposed for semiconductor facilities including the provisions for exceptional circumstances. EPA is proposing this method based on information received in response to our initial proposal from semiconductor manufacturers regarding the development of gas-and facility-specific heel factors. Although EPA does not have complete information on how LCD, MEMS, and PV facilities are currently estimating their emissions from manufacture and how they are currently accounting for heels, their gas use and manufacturing processes are similar to that of semiconductor manufacturing. As a result, EPA concludes that these facilities have the data required to develop a gas-and facility-specific heel factors and that it can be implemented with minimal burden.

3.1.5.4 Method for Estimating N_2O Emissions

EPA is proposing that electronics manufacturers estimate N_2O emissions from chemical vapor deposition processes and all other electronics manufacturing processes such as chamber cleaning, and that they estimate those emissions using the following proposed methods.

To estimate N_2O emissions from chemical vapor deposition, EPA is proposing the use of a facility-specific emission factor based on facility measurements of N_2O utilization for chemical vapor deposition at a facility, using 2006 ISMI Guidelines. Under this approach, EPA is proposing to permit the facility to apply the average N_2O utilization emission factor to all N_2O using chemical vapor deposition recipes. In cases where a facility has not developed a facility-specific N_2O utilization factor for chemical vapor deposition processes, EPA is proposing a default value in the range of ~0% to 40%. EPA is proposing a range due to a lack of information for N_2O utilization rate for chemical vapor deposition processes. In comments received in response to our initial proposal, industry provided information to support a N_2O utilization factor of 40%, primarily in 300 mm CVD processes. Taking the industry-provided 40% utilization value into account, EPA is proposing a default value within a range of values with 40% as the upper bound and ~0%.

To estimate N_2O emissions from all other manufacturing processes (e.g., chamber cleaning), EPA is proposing either a facility-specific utilization factor based on facility measurements using 2006 ISMI Guidelines, or applying a default utilization factor of 0% which assumes N_2O is not converted or destroyed during the manufacturing process. EPA is proposing this method due to a lack of information regarding other processes for which N_2O is used and N_2O utilization data in those processes. EPA has requested information on electronics manufacturing processes that use N_2O and N_2O utilization during those processes.

Additionally EPA is proposing that as part of determining annual facility N_2O emissions that if a facility employs abatement devices and it wishes to report N_2O emission reductions due to these devices it must adhere to the methods for reporting controlled emissions included in this proposal.

3.1.5.5 Method for Estimating Emissions of Heat Transfer Methods

To estimate the emissions of heat transfer fluids, EPA proposes that electronics manufacturers use the 2006 IPCC Tier 2b approach, which is a mass-balance approach.

3.1.5.6 Method for Reporting Controlled Emissions from Abatement Equipment

For this proposed rule, EPA is defining DRE as the efficiency of a control system designed to destroy or remove fluorinated GHGs, N_2O, or both. The DRE is equal to one minus the ratio of the mass of all relevant GHGs exiting the emission abatement system to the mass of

GHGs entering the emission abatement system. When fluorinated GHGs are formed in an abatement system, DRE is expressed as one minus the ratio of amounts of exiting GHGs to the amounts entering the system in units of CO_2-equivalents. In addition, EPA is clarifying that facilities may account for all abatement systems (e.g., multi-chamber POU, central devices) provided that they abide by the requirements proposed.

EPA is proposing to use the term destruction or removal efficiency (DRE) as opposed to "destruction efficiency" or "destruction," terms that are already defined in Subpart A of the Final MRR. EPA is proposing to use DRE because it is the term generally used by the electronics manufacturing industry. Furthermore, in addition to capturing the destruction of materials in the exhaust, the term also captures materials in the exhaust that are recycled or captured for reuse.

For purposes of this reporting rule, EPA is proposing that facilities that wish to document and report fluorinated GHG and N_2O emissions reflecting the use of abatement systems adhere to a method that would require: (1) documentation to certify that the abatement system is installed, operated, and maintained in accordance with manufacturers' specifications, (2) accounting for the system's uptime[3], and (3) either certification that the abatement system is specifically designed for fluorinated GHG and N_2O abatement and the use of an EPA default DRE value, or direct, proper DRE measurement to confirm the performance of the abatement system. Proper DRE measurement means measured in accordance with EPA's Protocol for Measuring Destruction or Removal Efficiency of Fluorinated Greenhouse Gas Abatement Equipment in Electronics Manufacturing (EPA's DRE Protocol).

The proposed approach requires annual certification to ensure that abatement systems for which controlled emissions are reported are installed, operating, and maintained according to manufacturers' specifications. This approach would also require that any DRE used in reporting emissions be based on an EPA default DRE value or on recent on-site measurements and actual uptime of the system, accounting for system redundancy. When process tools are equipped with multiple abatement systems designed for fluorinated GHGs and N_2O, the facility may account for the combined uptime for the specific calculation of controlled emissions. EPA anticipates this method for reporting controlled emissions will ensure that abatement systems have been properly installed, operated and maintained during each reporting period and that best available measured DRE values are used to estimate and report emissions.

[3] Uptime means the total time during the reporting year when the abatement system for which controlled emissions will be reported was properly installed, operated, and maintained.

3.1.6 Selection of Procedures for Estimating Missing Data

In general, it is not expected that data to estimate emissions from cleaning and etching would be missing; gas consumption data and indicators of activity data (e.g. wafer passes, finished wafers) is collected as business as usual. For this reason, EPA is not proposing procedures for estimating missing data from emissions from cleaning, etching or disposition processes. Because this proposal includes an EPA default DRE value for estimating and reporting controlled emissions, EPA proposes that no missing data procedures would apply.

When estimating heat transfer fluid emissions during semiconductor manufacture, the use of the mass-balance approach requires facilities to correct records for all inputs. Should the facility be missing records for a given input, heat transfer fluid emissions may be estimated using the arithmetic average of the emission rates for the year immediately preceding the period of missing data and the months immediately following the period of missing data. Alternatively it may be possible that the heat transfer fluid supplier has information in their records for the facility.

3.1.7 Selection of Data Reporting Requirements

Owners and operators would be required to report fluorinated GHG and N_2O emissions for the facility for all plasma etching, chemical vapor deposition, chamber cleaning, and wafer cleaning processes as well as all heat transfer fluid use. In addition, facilities would be required to report the following: method used to calculate emissions; factors used for gas utilization and by-product formation rates and the source for each factor for each fluorinated GHG and N_2O; production in terms of substrate surface area (e.g., silicon, PV-cell, LCD); for each fluorinated GHG and N_2O, annual gas consumed during the reporting year and gas-and facility-specific heel factors used; the apportioning factors used, a description of the engineering model used for apportioning gas usage, and facility-wide consumption estimates based upon development of the apportioning factors, independent of the consumption value calculated using purchase records; fraction of each gas fed into each process type that is fed into tools with abatement systems; descriptions and information about abatement systems through which fluorinated GHGs and N_2O flow; inputs in the mass-balance equation (for heat transfer fluid emissions); and example calculations. Where process categories defined in the Refined Method and/or default gas utilization and by-product formation rates are not used, facilities would be required to provide descriptions of individual processes or processes categories used to estimate emissions.

For each abatement system for which a facility is reporting controlled emissions, the following would be required: certification that the abatement device is installed, operated, and maintained according to manufacturers' specifications; the uptime and the calculations to determine uptime for that reporting year; the DRE used (i.e. either the EPA default DRE value or a properly measured DRE); and required documentation to use the EPA default DRE value or a properly measured DRE.

These data form the basis of the calculations and are needed for EPA to understand the reported emissions and verify their reasonableness.

3.1.8 Selection of Recordkeeping Requirements

EPA proposes that facilities keep records of data used to estimate emissions, records supporting values used to estimate emissions, purchase records, and invoices for gas purchases and sales. For those facilities that use facility-specific, recipe- specific gas utilization and by-production formation rates, EPA proposes that the following records be maintained: documentation that the rates were measured using the 2006 ISMI Guidelines, documentation that the measurements made are representative of fluorinated GHG and N_2O emitting processes at the facility, and the date and results of the initial and any subsequent tests to determine process tool gas utilization and by-product formation rates.

For those facilities that are reporting controlled emissions, EPA proposes that the following records be kept: documentation to certify that each abatement device used at the facility is installed, maintained, and operated in accordance with manufacturers' specifications; records of the uptime and the calculations to determine uptime; abatement system calibration and maintenance records; required documentation to use either the EPA default DRE value or a properly measured DRE.

These records consist of values that are directly used to calculate the emissions that are reported and are necessary to enable verification that the GHG emissions monitoring and calculations are done correctly.

3.2 Subpart L – Fluorinated GHG Producers

3.2.1 Definition of Affected Entities

Affected entities under subpart L are defined as any facility that produces a fluorinated gas from any raw material or feedstock chemical. Fluorinated gas production includes the production of fluorinated GHGs (including HFCs, PFCs, SF_6, NF3, and HFEs) and chlorofluorocarbons (CFCs) or hydrochlorofluorocarbons (HCFCs). EPA stipulates that production of fluorinated gases does not include the reuse or recycling of fluorinated GHG or the generation of HFC-23 during the production of HCFC-22.

Facilities that produce fluorinated gases will be required to report their fluorinated GHG emissions from fluorinated gas production, transformation, and destruction, as well as combustion-related CO_2, CH_4, and nitrous oxide (N_2O) emissions from stationary fuel combustion. Fluorinated gases include fluorinated GHGs (HFCs, PFCs, SF6, NF3, HFEs, etc.), CFCs, and HCFCs. However, emissions of HFC-23 from HCFC-22 production are addressed under subpart O and are therefore excluded from this subpart. Similarly, emissions of CFCs and HCFCs are addressed under the regulations implementing Title VI of the Clean Air Act and are therefore excluded from this subpart.

3.2.2 Summary of Initial Proposal

In the April 2009 proposed mandatory GHG reporting rule (74 FR 16448; April 10, 2009), the fluorinated GHG production subcategory was included as proposed subpart L. In the initial proposal for fluorinated GHG production, EPA proposed to require reporting from facilities emitting more than 25,000 mtCO2e from fluorinated GHG production and other source categories. EPA proposed monitoring based on a daily mass balance or yield approach that included measurements of the reactants and the fluorinated GHG product and byproducts. Under this approach, facilities would have had to calculate the difference between the expected production of each fluorinated GHG based on the consumption of reactants and the measured production of that fluorinated GHG, accounting for yield losses related to byproducts and wastes and accounting for streams that were recaptured and destroyed. Measurements of the various inputs and outputs were to be conducted with scales and flow meters meeting an accuracy and precision of 0.2 percent of full scale, and measured concentrations in streams were to meet an accuracy and precision of 5 percent.

EPA received a number of detailed comments regarding the subpart L proposal. Commenters focused on the applicability of the rule; the potential difficulty, expense, and

inaccuracy that would be associated with applying the proposed mass-balance approach to many facilities; and the need for inclusion of other monitoring approaches in the rule. These comments are discussed in more detail below in the sections to which they are relevant.

EPA recognizes the concerns that stakeholders have raised and decided not to finalize the April 2009 proposed subpart L but instead to issue a new proposal for emissions from fluorinated gas production. This proposal includes revisions to several of the provisions in the initial proposed subpart L.

3.2.3 Summary of Changes Since the Initial Proposal

Today's proposed subpart L rule incorporates a number of changes since the original proposal including, but not limited to, inclusion of fluorinated GHGs emitted from fluorinated gas production processes that are not producing fluorinated GHGs (i.e., production of CFCs and HCFCs), inclusion of transformation processes that produce products that are not F-GHGs (when those transformation processes are co-located with fluorinated gas production processes), inclusion of additional emission estimation methodologies that provide flexibility to facilities to estimate emissions using methods that may already be in place, and revision of the mass-balance approach.

3.2.4 Selection of Reporting Threshold

Under the re-proposed rule, owners and operators of fluorinated gas production facilities would be required to estimate and report GHG emissions if they are equal to or greater than 25,000 mtCO2e in the absence of control technology (e.g., thermal oxidation).

As is true for the other source categories covered by the Mandatory GHG Reporting Rule, EPA is proposing that fluorinated gas production facilities could cease reporting if their emissions were less than 25,000 mtCO2e per year for five consecutive years or less than 15,000 mtCO2e per year for three consecutive years.

A full discussion of the threshold selection analysis is available in the revised Fluorinated Gas Production TSD (EPA-HQ-OAR-2009-0927). For specific information on costs, including unamortized first year capital expenditures, please refer to section 4.

3.2.5 Selection of Proposed Monitoring Methods

EPA is proposing to allow facilities to use either a mass-balance approach or a site-specific, process-vent-specific emission factor (PSEF) approach to estimate their fluorinated

GHG emissions. The mass-balance approach is similar to that proposed in April, 2009, but has been modified in some details in response to comments. Facilities using either approach would be required to perform a one-time survey to identify the F-GHGs in certain emitted streams and to verify the destruction efficiency (DE) of any destruction devices every five years.

EPA is proposing that facilities that produce fluorinated gases perform an initial survey of the F-GHGs present in emissions from processes that would emit more than two metric tons per year of F-GHGs before the imposition of control technologies. Under this requirement, which would be one-time for any given process, facilities would be required to sample the vent(s) or stream(s) that, alone or together, would be expected to contain all the F-GHG by-products of the process. Facilities would be required to use EPA Method 18 (GC/ECD, GC/MS) or EPA Method 320 (FTIR) to identify F-GHGs that occur in concentrations above 0.1 percent in emitted streams.

3.2.5.1 Mass Balance Approach

In this action, EPA is proposing that facilities producing F-GHGs have the option of monitoring emissions using the mass balance approach. In this approach, facilities would calculate the difference between the expected production of each fluorinated GHG based on the consumption of reactants and the measured production of that fluorinated GHG, accounting for yield losses related to byproducts (including intermediates permanently removed from the process) and wastes. Yield losses that could not be accounted for would be attributed to emissions of the fluorinated GHG product. This calculation could be performed for either/any reactant (e.g., hydrocarbon or HF) to estimate emissions of the fluorinated GHG product for that reactant (i.e., the mass balance may be based on a carbon balance or a fluorine balance). If fluorinated GHG byproducts were produced and were not completely recaptured or completely destroyed, facilities would also estimate emissions of each fluorinated GHG byproduct.

Because the mass-balance approach assumes that losses from the process are emissions of the product, EPA believes that the mass-balance approach would only be appropriate for estimating emissions from F-GHG production, not production of CFCs, HCFCs, or polymers. However, EPA requests comment on this issue.

To be eligible to use the mass balance approach, facilities would have to demonstrate that their planned measurements could meet a statistical error limit required in the rule. If the facility could not demonstrate that it could meet the error limit, it would have to improve the accuracy and/or precision of its monitoring and measurement devices or opt to use another monitoring approach offered in the rule.

To carry out the mass balance approach, the facility would choose a reactant for yield calculation purposes. The facility would then weigh or meter the mass of that reactant fed into the process, any primary fluorinated GHG produced by the process, the mass of the reactant permanently removed from the process (i.e., sent to the thermal oxidizer or other equipment, not immediately recycled back into the process), any fluorinated GHG byproducts generated, and any streams that contain the product or fluorinated GHG byproducts and that are recaptured or destroyed. These measurements would be tracked on a monthly or more frequent basis and consolidated and recorded on a monthly basis. If monitored process streams included more than one component (product, byproducts, or other materials) in more than trace concentrations,[4] the facility would be required to monitor concentrations of products and byproducts in these streams. Finally, the facility would be required to perform monthly mass balance calculations for each product produced.

3.2.5.2 Process Specific Emissions Factor Approach

In this action, EPA is proposing an additional monitoring approach based on site-specific, process-specific emissions factors. This approach includes either calculation or measurement of process vent emissions depending on the size and fate of the emissions from the vent. Facilities would develop preliminary emissions estimates to determine the level of uncontrolled emissions from each process vent in processes subject to this subpart. For process vents with uncontrolled emissions of less than 10,000 mt CO2e (or less than 1 ton for emissions that include an F-GHG whose GWP does not appear in Table A-1 of Subpart A), facilities could conduct either engineering calculations or emissions testing to estimate emissions. Facilities could also conduct either engineering calculations or emissions testing to estimate emissions that were vented to a destruction device demonstrated to achieve a destruction efficiency of 99.9 percent (for fluorinated GHGs), as long as equipment or procedures[5] were in place to ensure that uncontrolled emissions did not occur. For other emissions, facilities would be required to conduct emissions testing to determine the process vent emission factor.

EPA is proposing less demanding measurement requirements for small and destroyed emission streams to ensure that the effort and resources expended to measure emissions are commensurate with the size of those emissions. This principle has been adopted both for other source categories in the GHG Reporting Rule and for numerous other EPA programs. However, EPA is requesting comment on some aspects of its proposed approaches.

[4] EPA is proposing to define "trace concentration" as any concentration less than 0.1 percent by mass of the process stream.

[5] Such equipment or procedures could include, for example, holding tank capacity, monitoring of by-pass streams, or compulsory process shutdowns in the event the destruction device remains off line.

3.2.5.3 Equipment Leak Emissions Estimation Approach

For completeness, EPA proposes that facilities monitoring of process vents be supplemented by monitoring of equipment leaks, whose emissions would not occur through process vents. To estimate emissions from equipment leaks, facilities will be required to use EPA Method 21 and the *Protocol for Equipment Leak Estimates* (EPA-453/R-95-017).

3.2.6 Selection of Procedures for Estimating Missing Data

In the event that a scale or flowmeter normally used to measure reactants, products, by-products, or wastes fails to meet an accuracy or precision test, malfunctions, or is rendered inoperable, EPA is proposing that facilities be required to estimate these quantities using other measurements where these data are available. For example, facilities that ordinarily measure production by metering the flow into the day tank could use the weight of product charged into shipping containers for sale and distribution as a substitute. It is EPA's understanding that the types of flowmeters and scales used to measure fluorocarbon production (e.g., Coriolis meters) are generally quite reliable, and therefore that it should rarely be necessary to rely solely on secondary production measurements. In general, production facilities rely on accurate monitoring and reporting of the inputs and outputs of the production process. Nevertheless, EPA is also proposing that if a secondary mass measurement for the stream is not available, producers can use a related parameter and the historical relationship between the related parameter and the missing parameter to estimate the flow.

If concentration measurements are unavailable for some period, EPA is proposing that the facility use the average of the concentration measurements from just before and just after the period of missing data.

EPA is requesting comment on these proposed methods for estimating missing data.

3.2.7 Selection of Data Reporting Requirements

Under the proposed rule, owners and operators of facilities producing fluorinated GHGs would be required to report both their fluorinated GHG emissions and the quantities used to estimate them on a process-specific basis. For the mass-balance approach, this includes the masses of the reactants, products, by-products, and wastes, and, if applicable, the quantities of any product in the by-products and/or wastes (if that product is emitted at the facility). The chemical identities of reactants, products, and by-products would also be reported, along with the chemical equations used to estimate emissions. For the process vent approach, data to be reported includes the activity data used to calculate emissions (e.g., the quantity produced,

transformed, or destroyed) and the emission factors used to estimate them. EPA is proposing that owners and operators report annual totals of these quantities.

Where fluorinated gas production facilities have estimated missing data, the facility would be required to report the reason the data were missing, the length of time the data were missing, the method used to estimate the missing data, and the estimates of those data.

We propose that facilities report these data because the data are necessary to verify facilities' calculations of fluorinated GHG emissions. We request comment on these proposed reporting requirements.

3.2.8 Selection of Recordkeeping Requirements

Maintaining records of the information used to determine the reported GHG emissions is necessary to enable us to verify that the GHG emissions monitoring and calculations were done correctly. Under the proposed rule, owners and operators of facilities producing fluorinated GHGs would be required to retain records documenting the data reported, including records of monthly emission estimation calculations, including all data that went in to the calculations, calibration records for flowmeters, scales, and gas chromatographs, and documentation of emission factor development activities. These records are necessary to verify that the GHG emissions monitoring and calculations were performed correctly.

3.3 Subpart OO – Importing/Exporting of Pre-charged Equipment and Foams

3.3.1 Definition of Affected Entities

Affected entities under subpart OO are defined as any entity that is an importers and/or exporter of pre-charged equipment or closed-cell foams that contain fluorinated GHGs. A variety of products containing fluorinated greenhouse gases (F-GHGs), nitrous oxide (N_2O), and carbon dioxide (CO_2) are imported into and exported from the United States. Pre-charged equipment includes air-conditioning, refrigeration, and electrical equipment. Closed-cell foams that are imported and exported include polyurethane (PU) rigid foam used in insulation in domestic refrigerators and freezers,; commercial refrigeration foam,; PU rigid sandwich panel continuous and discontinuous foam; extruded polystryrene (XPS) sheet foam; and XPS boardstock foam.

3.3.2 Summary of Initial Proposal

In the initial proposed rule EPA did not require reporting of the quantities of GHGs imported and exported inside products. EPA was concerned that it would be difficult for importers and exporters to identify and quantify the quantities of GHGs inside some products and that the number of importers and exporters would be high. However, EPA requested comment on the option of requiring reporting of imports and exports of HFCs and SF_6 contained in pre-charged air-conditioning, refrigeration, and electrical equipment and in closed cell foams. EPA noted that for these products, information on the size and chemical identity of the charge or blowing agent is likely to be readily available to importers and exporters (e.g., from nameplates affixed to equipment, servicing manuals, and product information for foams). Moreover, as noted above, the total quantities of imported and exported F-GHGs in pre-charged equipment and foams are significant.

3.3.3 Summary of Current Proposal

After carefully considering the comments and available information on imports and exports of F-GHGs inside pre-charged equipment and foams, EPA is proposing to require reporting of these imports and exports. Importers and exporters of pre-charged equipment and closed-cell foams would be subject to requirements similar to those for importers and exporters of bulk GHGs. In addition, equipment importers would be required to report the types and charge sizes of equipment and the number of pieces of each type of equipment that they imported or exported, while foam importers would be required to report the volume of foam and F-GHG density of the foam that they imported. As is true for importers and exporters of bulk F-GHGs, importers and exporters of equipment and foam would only be required to report if their total imports or exports exceeded the 25,000 mtCO2e threshold.

3.3.4 Selection of Reporting Threshold

Under the current proposal, EPA is proposing to require that importers and exporters of F-GHGs contained in pre-charged equipment and closed cell foams report their imports and exports if either their total imports or their total exports, in equipment, foams, and in bulk, exceed 25,000 $mtCO_2e$ per year. This threshold is the same as that for bulk imports and exports.

3.3.5 Selection of Proposed Monitoring Methods and QA/QC Requirements

EPA proposes to require importers and exporters of equipment and foams to estimate their imports and exports of each F-GHG by multiplying the mass of the F-GHG contained in each type of equipment or foam by the number of pieces of equipment or by the volume of foam,

as appropriate. EPA believes that information on F-GHG identity and charge size (or density, for foams) should be readily available to importers and exporters.

3.3.6 Selection of Procedures for Estimating Missing Data

Procedures for estimating missing data are not provided for importers and exporters of fluorinated GHGs contained in pre-charged equipment or closed-cell foams. A complete record of all measured parameters used in tracking fluorinated GHGs contained in pre-charged equipment or closed-cell foams is required.

3.3.7 Selection of Data Reporting Requirements

Under the current proposal, EPA is proposing to require importers and exporters of pre-charged equipment and closed cell foams to report the following:

(1) The total mass in metric tons of each fluorinated GHG imported or exported in pre-charged equipment or closed-cell foams.

(2) For each type of pre-charged equipment, the identity of the fluorinated GHG used as a refrigerant or electrical insulator, charge size (holding charge[6], if applicable), and number imported or exported.

(3) For closed-cell foams that are imported or exported inside of appliances, the identity of the fluorinated GHG contained in the foam, the quantity of fluorinated GHG contained in the foam in each appliance, and the number of appliances imported for each type of appliance.

(4) For closed cell-foams that are not inside of appliances, the identity of the fluorinated GHG, the density of the fluorinated GHG in the foam (kg F-GHG/cubic foot), and the quantity of foam imported or exported (cubic feet) for each type of closed-cell foam.

(5) Dates on which the pre-charged equipment or closed-cell foams were imported or exported.

(6) Ports of entry through which the pre-charged equipment or closed-cell foams passed.

(7) Countries from or to which the pre-charged equipment or closed-cell foams were imported or exported.

[6] This refers to any holding charge consisting of a fluorinated GHG. Holding charges consisting of other gases, such as nitrogen, are not included.

EPA is proposing to collect this information because it is necessary either to understand the total volume of F-GHGs imported or exported inside of pre-charged equipment and foams (and thereby contributing to the U.S. supply of F-GHGs) or to verify submitted information.

3.3.8 Selection of Recordkeeping Requirements

EPA is proposing to require importers and exporters of equipment and closed cell foams to retain the following records:

(1) a copy of the bill of lading for the import;
(2) the invoice for the import; and
(3) for imports, the U.S. Customs entry form.

This information is necessary to verify submitted information.

3.4 Subpart SS – Electrical Equipment and Components Manufacturing

3.4.1 Definition of Affected Entities

Affected entities under subpart SS are defined as electrical equipment manufacturers of SF_6-insulated closed-pressure system equipment and sealed-pressure system equipment including gas-insulated substations, circuit breakers, other switchgear, gas-insulated lines, or power transformers containing sulfur-hexafluoride (SF_6) or perfluorocarbons (PFCs).

Electrical equipment manufacturers purchase bulk SF_6 gas to (1) install a nominal charge in high-voltage closed-pressure equipment, (2) ship alongside closed-pressure equipment for topping off at installation site, (3) fill sealed-pressure equipment with its intended lifetime supply of SF6, and (4) develop and test equipment. Fugitive emissions of SF_6 from equipment manufacturers typically occur during the manufacturing of equipment but can also occur during the other uses of SF_6 at manufacturing facilities.

While EPA believes that SF_6 represents the majority of emissions from this source category, manufacturers may also use PFCs as dielectrics and heat transfer fluids in power transformers. For example the PFC perfluorohexane (C_6F_{14}) is used for retrofitting CFC-113 cooled transformers.

According to the U.S. Inventory of Greenhouse Gas Emissions and Sinks: 1990-2007 (U.S. Environmental Protection Agency, 2009), total U.S. estimated emissions of SF_6 from electrical equipment manufacturers was estimated to be 0.81 million metric tons CO_2e in 2006.

EPA is proposing to require reporting from electrical equipment manufacture and refurbishment facilities because these operations represent a significant source, approximately 5% of SF_6 emissions. It is estimated that ten equipment manufacturers were responsible for these emissions.

EPA is proposing to include emissions of PFCs emitted during the manufacture or refurbishment of PFC-containing power transformers because the National Inventory has no information on this source and because use of transformers is expected to grow in the future.

This source category comprises electrical equipment manufacturers and refurbishers of SF6 or PFC-insulated closed-pressure system equipment and sealed-pressure system equipment including gas-insulated substations, circuit breakers, other switchgear, gas-insulated lines, or power transformers containing sulfur-hexafluoride (SF_6) or perfluorocarbons (PFCs).

3.4.2 Selection of Reporting Threshold

EPA is proposing requiring electrical equipment manufacturers to report their SF_6 and PFC emissions if their total annual purchases of SF_6 and PFCs exceed 23,000 lbs. This consumption-based threshold is equivalent to an emissions-based threshold of 25,000 mtCO_2e, assuming an average manufacturer emission rate of 10%.

3.4.3 Selection of Proposed Monitoring Methods and QA/QC Requirements

In developing the proposed approach, EPA reviewed the 2006 IPCC Guidelines, the U.S. GHG Inventory, DOE 1605(b), EPA's Climate Leaders Program, and The Climate Registry. In the IPCC Guidelines, Tiers 1 and 2 are based on default and country-specific SF6 and PFC emission factors, but Tier 3 is based on a mass-balance approach for estimating SF6 and PFC emissions at each life-cycle stage of the equipment.

The proposed monitoring methods for calculating SF_6 and PFC emissions from electrical equipment manufacturing and refurbishment are similar to the methodologies described in the 2006 IPCC Guidelines Tier 3 methods for emissions from electrical equipment manufacturing.

EPA proposes that all SF_6 and PFC emissions be reported, including those from equipment testing, manufacturing, decommissioning and disposal, refurbishing, and from storage cylinders, as well as combustion-related CO_2, CH_4, and nitrous oxide (N_2O) emissions from stationary fuel combustion. This requirement would apply only to electrical equipment manufacturers where SF6 and PFC purchases exceed 23,061 lbs per year. The Tier 3 approach is being proposed because it is the most accurate and it is feasible for all equipment manufacturers to conduct the mass balance analysis for SF_6 and PFCs using readily available information.

A comparable mass-balance approach has also been proposed for subpart DD *Sulfur Hexafluoride (SF_6) and Perfluorocarbons (PFCs) from Electrical Equipment at an Electric Power System*. The mass-balance approach works by tracking and systematically accounting for all facility uses of SF_6 and PFCs during the reporting year. The quantities of SF_6 and PFCs that cannot be accounted for are assumed to have been emitted to the atmosphere. The emissions of SF_6 and PFCs would be estimated and reported separately.

In addition, EPA proposes that electrical equipment manufacturers be required to keep records for the QA/QC requirements including check-out sheets and weigh-in procedures for cylinders, residual gas amounts in cylinders sent back to suppliers, invoices for gas and equipment purchases or sales, and documentation of recycling and destruction. The records that are being proposed are the minimum needed to reproduce and confirm emission calculations.

3.4.4 Selection of Procedures for Estimating Missing Data

It is expected that equipment manufacturers should be able to obtain 100 percent of the data needed to perform the mass balance calculations for both SF_6 and PFCs. The use of the mass-balance approach requires correct records for all inputs. However, if needed, missing data can be replaced using data from similar manufacturing operations, and from similar equipment testing and decomissioning activities for which data is available.

3.4.5 Selection of Data Reporting Requirements

EPA proposes annual reporting for the electrical equipment manufacturing and refurbishing industry. Equipment manufacturers would report all SF_6 and PFC emissions, including those from equipment testing, equipment manufacturing, and bulk SF_6 and PFC handling. However, the emissions would not need to be broken down and reported separately for testing, manufacturing, or bulk SF_6 and PFC handling. Along with their emissions, electrical equipment manufacturers would be required to submit the following supplemental data: SF_6 and PFCs with or inside equipment delivered to customers, SF_6 and PFCs returned by customers with or inside equipment, bulk SF_6 and PFC purchases, SF_6 and PFCs sent off-site for destruction or to be recycled, SF_6 and PFC returned from offsite after recycling, SF_6 and PFCs stored in containers at the beginning and end of the year, SF_6 and PFCs returned to suppliers. If applicable, combustion-related CO_2, CH_4, and nitrous oxide (N_2O) emissions from stationary fuel combustion.

These data would be submitted because they are the minimum data that are needed to understand and reproduce the emission calculations that are the basis of the reported emissions.

3.4.6 Selection of Recordkeeping Requirements

In this action, EPA is proposing that electrical equipment manufacturers be required to keep records documenting (1) their adherence to the QA/QC requirements specified in the proposed rule, and (2) the data that would be included in their emission reports, as specified above.

SECTION 4
ENGINEERING COST ANALYSIS

4.1 Introduction

EPA estimated costs of complying with the rule for process emissions of GHGs in each affected industrial facility. EPA used available industry and EPA data to characterize conditions at affected sources. Incremental monitoring, recordkeeping, and reporting activities were then identified for each type of facility, and the associated costs were estimated.

4.2 Overview of Cost Analysis

The costs of complying with the rule will vary from one facility to another, depending on the types of emissions, the number of affected sources at the facility, existing monitoring, recordkeeping, and reporting activities at the facility, etc. The costs include labor costs for performing the monitoring, recordkeeping, and reporting activities necessary to comply with the rule. For affected facilities, costs include monitoring, recording, and reporting of GHG emissions from production processes and from stationary combustion units. All costs referred to in this section are reported in 2006 dollars.

For each source category, we first provide a general overview of baseline reporting (if data are available); two costs components associated with this information collection; labor costs (i.e., the cost of labor by facility staff to meet the information collection requirements of the rule); and capital and operating and maintenance costs (e.g., the cost of purchasing and installing monitoring equipment or contractor costs associated with providing the required information). Additional details of the data, methods, and assumptions underlying the costs are documented in a separate cost appendix and in accompanying Technical Support Documents (TSDs). The TSDs also include information on the assumptions and methods used to identify representative entities or groups of entities used to develop the cost analysis for each subpart.

4.2.1 Baseline Reporting

When data are available to determine how many companies are currently implementing approaches consistent with the methods at the facility level to meet internal GHG management programs or state or voluntary reporting programs at the domestic or international level, we include a discussion of the baseline reporting practices. When data are not available, EPA is assuming that none of the facilities in these source categories are currently reporting emissions and that many of the requirements will result in “new” or “full” costs to meet reporting requirements. Specifically, EPA is assuming that there will be additional costs for any sampling

and testing in the requirements in methods (i.e., carbon contents of process inputs, such coke, coal, carbonate composition, or actual emissions). EPA is also assuming that additional costs will be incurred for preparing monitoring and QA/QC plans, performing the calculations, reporting the results, and maintaining records.

4.2.2 Reporting Costs

To ensure consistency in the development of cost estimates across all sources, EPA developed a cost spreadsheet template that each subpart used to compile, document, and calculate per unit reporting costs. Please refer back to Section 3 for information on the subpart process for source categories. Detailed instructions were provided along with the cost spreadsheet template that clearly explained the data to be compiled and calculated. The template included three tables; analysis of reporting thresholds, analysis of monitoring and reporting options, and unit costs for monitoring and reporting. Key variables and data fields were clearly defined to ensure that each sub group developed costs around a standard set of methods and assumptions (e.g., method for annualization of capital costs, interest rate to be applied to capital).

Labor Costs. The costs of complying with and administering this rule include the time of managers, technical, and administrative staff in both the private sector and the public sector. Staff hours are estimated for activities including:

- monitoring (private): staff hours to operate and maintain emissions monitoring systems;
- reporting (private): staff hours to gather and process available data and reporting it to EPA through electronic systems; and
- assuring and releasing data (public): staff hours to quality assure, analyze, and release reports.

Staff activities and associated labor costs may vary over time. Thus, cost estimates are developed for start-up, first-time reporting, and subsequent reporting.

Loaded hourly labor rates (also referred to as “wage rates”) were developed for several labor categories to represent *the employer costs to use an hour of employees’ time* in each of the manufacturing sector labor categories used in this analysis. The labor categories correspond to the job responsibilities of the personnel that are likely to be involved in GHG emissions monitoring activities at the manufacturing facility level to comply with the rulemaking.

For purposes of this study, EPA adopted the methodology used by Cody Rice (2002) to calculate the wage rates for the EPA’s Toxics Release Inventory (TRI) Program. Thus, the *wage*

rates calculated for different labor categories included the *employer costs for employee compensation* (comprising the basic wages and the corresponding benefits) and *the overhead costs to the employer*.[7]

For each labor category, the following formula was used to calculate the wage rates:

Loaded Hourly Labor Rate ($/hr.) = Basic Wages ($/hr.) *
(1 + Benefits Loading Factor + Overhead Loading Factor).

The *benefits loading factor* corresponds to the relative share of benefits compensation in the total employee compensation (comprising basic wages and benefits). Although the benefits factor tends to vary by labor category and by industry (0.37 to 0.50), for purposes of this analysis, we have assumed the benefits loading factor (1.7) to remain the same for each labor category across all industries within the manufacturing sector due to a lack of availability of necessary industry-specific data on benefits paid to employees.

The *overhead loading factor* corresponds to the share of overhead costs to the employer relative to the total employee compensation. For purposes of this analysis, we have also adopted the same overhead loading factor that Cody Rice (2002) used in her wage rate calculations. Thus the overhead loading factor that we used in the wage rate calculations remains the same for all labor categories and across all industry types within the manufacturing sector. The overhead loading factor was assumed to be 0.17.

The loaded labor rates for the four labor categories that are used in the cost analysis for each subpart covered under this rule and are also reported in the appropriate sectors labor cost tables in the following sections.

Table 4-1. Labor Categories and Hourly Rates

Labor Category	Description	Loaded Hourly Rate ($/hour)
Legal	Oversees legal aspects of company	$101.00/hour

[7]For each employee, the employer also incurs *overhead costs* (comprising the rental costs of the office space, computer hardware and software, telecommunication and other equipments, organizational support, etc.) required for and used by the employee to effectively fulfill his/her job responsibilities. These costs are over and above the employee compensation costs.

	reports and data-reporting forms.	
Managerial	Oversees work at a high level and is the final authority on all reporting requirements.	$71.03/hour
Technical	Conducts monitoring of emissions sources, checks for accuracy, performs measurements.	$55.20/hour
Clerical	Assists with documentation and recording information	$29.65/hour

Capital and O&M Costs. This includes the cost of purchasing and installing monitoring equipment or contractor costs associated with providing the required information. Selected subparts do not require capital expenditures because the selected monitoring option does not require capital equipment or the reporter already owns the necessary monitoring equipment. Equipment costs include both the initial purchase price of monitoring equipment and any facility/process modification that may be required. For example, the cost estimation method for mobile sources involves upstream measurement by the vehicle manufacturers. This may require an upgrade to their test equipment and facility. Based on expert judgment, the engineering costs analyses annualized capital equipment costs with the appropriate lifetime and interest rate assumptions. Cost recovery periods vary by industry (5 to 15 years) with one-time capital costs are amortized at a rate of 7%.

Other Recordkeeping and Reporting. Additional reporting ($500) costs was added to all subparts.

Cost Analysis by Subpart. The balance of section 4 provides the cost data by subpart. The data are the basis for the economic impact analysis described in detail in Section 5 of this document. This chapter provides these data, as well as background information needed to understand the engineering costs analysis conducted for each source and the reporting option selection.

4.3 Cost Analysis for Subpart I – Electronic Manufacturers

4.3.1 Model Facility Development

This analysis is based on the costs of monitoring fluorinated greenhouse gas emissions from semiconductor manufacturing facilities. Semiconductor facilities constitute the majority of the electronics facilities likely to report under the rule, and EPA has improved its understanding

of semiconductor facilities and their emissions through the PFC Reduction/Climate Partnership for Semiconductors, which has been in place since 1995.

In the proposed rule, semiconductor facilities annual costs differ from those for other electronics manufacturing facilities (i.e., facilities that manufacture microelectromechanical systems, liquid crystal displays, and photovoltaics) because they are subject to different reporting requirements, as detailed below under "Monitoring Costs". In addition, microelectromechanical systems (MEMS), liquid crystal display (LCD), and photovoltaics (PV) manufacturing use fewer types of F-GHGs than semiconductor manufacturing facilities. Therefore, cost estimates for these other types of electronics facilities were developed using cost estimates from EPA's initial proposal for other semiconductor facilities and scaling these costs to account for the use of a smaller set of gases.[8]

4.3.2 Determination of Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into four elements, which are described below.

Monitoring costs. The following types of monitoring costs were identified:

Collection of activity data for estimating F-GHG emissions. In the proposed rule, costs for collecting activity data differ depending on type of facility (semiconductor or MEMS, LCD, and PV). In the proposed rule, semiconductor facilities would be required to use an approach for estimating emissions which includes (1) gas consumption as calculated using the facility's purchase records, inventory, and gas-and facility-specific heel factors, (2) facility specific methods for apportioning gas usage by process category, (3) emissions factors (including factors for by-products) based on refined process categories, and (4) either EPA published default destruction or removal efficiency (DRE) value or properly measured DRE. This approach is referred to as the "Refined Method." Facilities could either use emissions factors provided by EPA or facilities would develop or acquire the emissions factors from process equipment manufacturers. The costs presented in this analysis reflect the first approach. In addition, facilities that have monitoring infrastructure or the necessary data to estimate emissions obtained through

[8] In its initial proposal for electronics manufacture, EPA proposed different requirements for the largest semiconductor facilities (those with annual capacities greater than 10,500 m^2 silicon) and all other semiconductor facilities. In the initial proposal all other semiconductor facilities were required to estimate their emissions using an approach based on the IPCC Tier 2b method.

recipe-specific measurements would be permitted to do so. Those costs are not included in this analysis because it is optional. EPA also considered another approach for estimating emissions from semiconductor facilities which includes (1) gas consumption as calculated using the facility's purchase records, inventory, and gas-and facility-specific heel factors, (2) facility specific methods for apportioning gas usage by IPCC's Tier 2b two process categories (clean and etch), (3) IPCC Tier 2b default emissions factors, and (4) either EPA published default DRE value or properly measured DRE. This approach is referred to as the "Modified Tier 2b Method." Other electronics manufacture facilities (i.e. MEMS, LCD, PV facilities) also would also be required to estimate emissions using the Modified Tier 2b Method.

Annual costs to report controlled emissions from abatement systems. Under the proposed rule, any facility that wishes to reflect abatement of fluorinated GHGs in its emissions estimates would be required to certify that the abatement system is installed, operated, and maintained in accordance with manufacturers' specifications and either use EPA published DRE default value or properly measured DRE. Properly measured DRE costs were estimated assuming that only the 23 "large" semiconductor facilities that participate in EPA's PFC Reduction/Climate Partnership for the Semiconductor Industry use abatement devices and would incur costs for verifying the DREs of these systems. This assumption likely provides a conservative overestimate of cost as not all EPA Partners use F-GHG emissions abatement systems. Also, those facilities that have abatement systems and choose to use EPA published default DRE value are assumed to incur only the cost of assuring their abatement system is properly installed, operated, and maintained, and accounting for uptime and no cost for measurement of DREs. Facilities that manufacture electronic devices other than semiconductors (PVs, MEMS, etc.) and semiconductor facilities that do not participate in EPA's PFC Reduction Partnership (119 semiconductor facilities) and smaller semiconductor facilities that participate in EPA's PFC Reduction/Climate Partnership (33 semiconductor facilities) are assumed to incur no costs to validate DREs. The 23 "large" semiconductor facilities that participate in EPA's PFC Reduction/Climate Partnership for the Semiconductor Industry using abatement systems and opt to reflect abatement of F-GHG emissions through DRE measurements are assumed, on average, to make ten DRE measurements per year.

Collection of data for estimating heat transfer fluid (HTF) emissions. In the proposed rule, electronics manufacturing facilities that use heat transfer fluids would be required to account for emissions from use of heat transfer fluids using a mass-balance approach.

Our understanding is that heat transfer fluids are widely used within semiconductor manufacturing; EPA is uncertain about heat transfer fluid use in other electronics manufacturing facilities. For this reason, we did not account for heat transfer fluid use in other electronics manufacturing facilities. The mass-balance approach uses company-specific data and accounts for differences among facilities' HTFs (which vary in their global warming potentials), leak rates, and service practices.

Record keeping costs. Additional recordkeeping ($1,700 per entity) were added to each facility.

Reporting costs. The following types of reporting costs were identified:

Reporting F-GHG emission estimate. In the proposed rule, electronics manufacturing facilities would be required to complete and submit company-specific annual reports. For purposes of the proposal, facilities that employ abatement systems and wish to reflect the emission reductions due to these systems in their emissions estimates, certification that the system is installed, operated, and maintained in accordance with manufacturers' specifications would be required to be included in the company-specific annual reports, and for facilities that choose to reflect emissions reductions through direct measurement of DRE at the facility, performance confirmed through direct DRE measurement (i.e., consistent with EPA's DRE Protocol) would be required.

Reporting heat transfer fluid emissions estimate. In the proposed rule, electronics manufacturing facilities would be required to complete and submit data-reporting forms. Because EPA is uncertain about whether other electronics manufacturing facilities (i.e. electronics manufacturing facilities other than semiconductor manufacturing facilities), we only included costs for reporting emissions from heat transfer fluids for semiconductor manufacturing facilities.

4.3.3 Proportion of Facilities in the Different Model Facility Levels

Semiconductor, MEMS, and LCD facilities would determine whether they exceed the emissions-based threshold using IPCC Tier 1 emission factors and assuming no abatement. Because we understand that heat transfer fluids are widely used within semiconductor manufacturing, semiconductor manufacturers would also add 10% of total clean and etch emissions at a facility to their estimate. For PV facilities, annual emissions would be estimated by multiplying annual F-GHG consumption by the appropriate GWP factor. For semiconductor facilities, 91 entities out of 175 entities exceed the 25,000 mtCO_2e threshold which includes 96%

of total semiconductor emissions. For MEMS facilities, the 25,000 $mtCO_2e$ threshold includes two entities out of 12 entities and includes 66% of total MEMS emissions. For LCD facilities, no entities exceed the 25,000 $mtCO_2e$ threshold. Only one PV facility is included in the 25,000 $mtCO_2e$ threshold which includes 47% of total PV emissions. The number of each type of facility that EPA estimates will meet the threshold 25,000 $mtCO_2e$ threshold and required to report is identified in Table 4-2.

Table 4-2. Number of Representative Affected Entities Used in the Cost Analysis

Threshold	Number of Representative Entities			
	Semiconductors (All)	MEMS	Liquid Crystal Display	Photovoltaics
1,000	134	10	5	16
10,000	108	4	1	1
25,000	91	2	0	1
100,000	55	0	0	0

4.3.4 Assigning Costs to Cost Elements

Assigning costs to each of the cost elements was completed using the four labor categories and associated labor rates presented in Table 4-1. EPA assigns responsibilities to each labor category to estimate labor hours. Finally, EPA estimates the annualized capital costs and operation & maintenance (O&M) costs for each of the cost elements

Determining Labor Categories.

To evaluate labor costs, it was not only necessary to determine the amount of time required for all of the tasks associated with monitoring, but also to determine who will perform each task. The four labor categories used in this analysis for this subpart are presented in Table 4-3 and include legal, managerial, technical and clerical.

Table 4-3. Labor Categories and Hourly Rates

Labor Category	Description	Loaded Hourly Rate ($/hour)
Legal	Oversees legal aspects of company reports and data-reporting forms.	$101.00/hour
Managerial	Oversees work at a high level and is the final authority on all reporting requirements.	$71.03/hour

Technical	Conducts monitoring of emissions sources, checks for accuracy, performs measurements.	$55.20/hour
Clerical	Assists with documentation and recording information	$29.65/hour

Allocate Responsibilities and Estimate Labor Hours.

The burden hours and costs borne by semiconductor facilities using the Refined Method were estimated using IPCC's Tier 2b method from our initial proposed method for other semiconductor facilities and also using information received from industry. EPA also estimated the burden hours and costs for using the Modified Tier 2b Method using IPCC's Tier 2b method from our initial proposed method for other semiconductor facilities and also using information received from industry for estimating gas-and facility-specific heel factors. The burden hours and costs borne by other electronics manufacturers, MEMS, LCD, and PV, were estimated using cost estimates from EPA's initial proposal for other semiconductor facilities and scaling these costs down to account for the use of a smaller set of gases, as these facilities use fewer types of F-GHGs than the semiconductor manufacturing facilities. In addition, information received from industry on burden hour estimates for technical staff to measure gas- and facility-specific heel factors were included for MEMS, LCD, and PV manufacturers. Table 4-4 presents the burden hours allocated to each labor category across all affected facility types covered under subpart I.

The hours and costs for estimating emissions of heat transfer fluids were based on the ICR for EPA's SF_6 Emission Reduction Partnership for Electric Power Systems. Under the SF_6 Partnership, electric power systems report emissions using a mass-balance method that is essentially identical to that proposed for heat transfer fluids in semiconductor facilities. Finally, the costs of proper DRE measurements were estimated based on EPA's experience in conducting multiple DRE measurements in semiconductor facilities.

Table 4-4. Responsibilities for Regulation Compliance by Labor Category Per Facility

Cost Element	Responsibilities and Hours by Labor Category							
	Legal		Managerial		Technical		Clerical	
	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours
Semiconductors—Refined Method								
Monitoring								
Collection of activity data for F-GHG emission estimate			Provide quality assurance of analyses and authorize completeness of the checks.	7.2	Collect data on gas consumption, gas utilization, and by-product formation. Perform calculation for nine process categories using default factors provided by EPA.	454	Assist in recording and maintaining data collected on gas consumption, gas utilization and by-product formation	
Collect data for mass-balance calculation of Heat Transfer Fluids			Provide quality assurance of analyses and authorize completeness of the checks.	4	Collect activity data related to HTF emissions	17	Assist in recording and maintaining data on collected activity data related to HTF emissions	11
Reporting								
Complete and submit company-specific annual report	Oversee legal aspects of annual report submission	0.3	Provide quality assurance of annual report.	10.8	Complete and submit company-specific annual report	25.3	Assist with completing and submitting the company-specific annual report	8.4
Complete and submit data reporting forms for mass-balance calculation of Heat Transfer Fluids			Review and submit data reporting form.	3.5	Review instructions and complete the form for data reporting	3.5	Maintain data reporting records.	1.7
MEMS								
Monitoring								
Collection of activity data for F-GHG emission estimate			Provide quality assurance of analyses and authorize completeness of the checks.	2.2	Collect data on gas consumption. Perform calculations using IPCC Tier 2b default emission factors.	30.4	Assist in recording and maintaining data collected on gas consumption, gas utilization and by-product formation	
Reporting								
Completion of company-specific annual report	Oversee legal aspects of annual report submission	0.1	Provide quality assurance of annual report.	3.2	Complete and submit company-specific annual report	7.6	Assist with completing and submitting the company-specific annual report	2.5

Cost Element	Responsibilities and Hours by Labor Category							
	Legal		Managerial		Technical		Clerical	
	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours
Liquid Crystal Display								
Monitoring								
Collection of activity data for F-GHG emission estimate			Provide quality assurance of analyses and authorize completeness of the checks.	3.6	Collect data on gas consumption. Perform calculations using IPCC Tier 2b default emission factors.	50.6	Assist in recording and maintaining data collected on gas consumption, gas utilization and by-product formation	
Reporting								
Completion of company-specific annual report	Oversee legal aspects of annual report submission	0.1	Provide quality assurance of annual report.	5.4	Complete and submit company-specific annual report	12.7	Assist with completing and submitting the company-specific annual report	4.2
Photovoltaics								
Monitoring								
Collection of activity data for F-GHG emission estimate			Provide quality assurance of analyses and authorize completeness of the checks.	4.3	Collect data on gas consumption. Perform calculations using IPCC Tier 2b default emission factors.	60.8	Assist in recording and maintaining data collected on gas consumption, gas utilization and by-product formation	
Reporting								
Completion of company-specific annual report	Oversee legal aspects of annual report submission	0.2	Provide quality assurance of annual report.	6.5	Complete and submit company-specific annual report	15.2	Assist with completing and submitting the company-specific annual report	5.1

Capital Cost Annualization and O&M Costs

There are no associated capital or O&M costs.

Other Costs

EPA estimates that the per-facility optional cost of validating, documenting, and reporting DREs of abatement devices is $1,766 if a facility uses EPA published DRE value, and $71,766 if a facility properly measures the DREs in accordance with EPA's DRE Protocol. Since all facilities must certify their abatement systems are properly installed, maintained, and operated, the associated cost of $1,766 applies to all options for reporting DREs. The cost of certifying that the abatement systems are properly installed, maintained, and operated was based an assumption that such a process would require 32 hours of a technician's time. This certification process also includes an annual assessment of the equipment uptime. It is assumed there are no other costs associated with using default DRE value. The cost for two weeks of testing for facilities that measure DREs as opposed to using EPA published default value is estimated to be $70,000. The cost estimate is based on an assumption that only the 23 large facilities that participate in EPA's PFC Reduction/Climate Partnership for the Semiconductor Industry use abatement devices and would incur costs for properly measuring the DREs of these systems and that the average large facility has fifty etch tools, all of which have F-GHG abatement systems. Because 20% of these fifty systems are required to be tested annually, we assume testing of ten devices per year and two weeks to test these ten systems. The cost for two weeks' worth of testing was based on industry estimate and EPA's experience conducting DRE testing. While ninety percent of this cost is related to labor and ten percent is related to freight shipments and measurement study supplies, it is assumed that the facilities outsource the DRE measurement and thus this cost is not considered a labor cost for the facility.

4.3.5 Estimation of Facility Costs for Each Threshold Level

Once the labor hours were calculated, by category, for each of the cost elements, they were multiplied by the associated labor rates to estimate labor costs per facility for each type of facility (semiconductor facilities, MEMS facilities, liquid crystal display facilities, and photovoltaic facilities). Additional costs as stated under "Other Costs" are added for those facilities that employ abatement devices and wish to reflect the emission reductions due to these devices in their emissions estimates. Finally, the unit cost per facility was multiplied by the number of facilities that exceed the reporting threshold for each type of facility, resulting in the total national costs per year for this sector.

4.4 Cost Analysis for Subpart L—Fluorinated Gas Production

4.4.1 Model Facility Development

For the Fluorinated Gas Production subpart, model facilities were developed based on the number of products at a single facility using known data for Fluorinated Gas facilities. Facilities were then categorized as producing one, three or six products using either continuous or batch processes. Facilities that were assumed to use continuous processes to produce their products were assumed to employ two processes per product and two vents per process. Facilities that were assumed to use batch processes to produce their products were assumed to employ five processes per product and five vents per process.

Option 1, the Mass Balance Approach, would require that a monthly fluorine or carbon balance of all inputs and outputs be performed using measurements of the masses of the inputs and outputs and of the fluorine or carbon content of the inputs and outputs. Fluorinated greenhouse gas (GHG) emissions would be calculated from the difference between fluorine- or carbon-in and fluorine- or carbon-out.

Option 2, the Process Vent Method, would require the development of emission factors for each process vent. For vents whose pre-control GHG emissions exceeded 10,000 $mtCO_2e$/year and were not vented to a destruction device with a destruction efficiency of at least 99.9 percent, facilities would be required to use emissions testing to establish the emission factor. For other vents, facilities could use engineering calculations to establish the emission factor. For the purpose of this evaluation it was assumed that half of the process vents had pre-control GHG emissions over 10,000 mtCO2e per year, and that half of these were not vented to destruction devices with destruction efficiencies of at least 99.9 percent. Thus, for the "average" facility, it was assumed that 25 percent of vents would be measured by emission testing and the other 75 percent would be evaluated using engineering calculations. Under the proposed rule, facilities would be required to develop emission factors in the first year and to update them every five years thereafter. In addition, facilities would be required to estimate their emissions from equipment leaks every year.

When calculating the cost impact for the Process Vent Method, it was apparent that a single "outlier" facility was distorting the average cost per facility. This outlier is comprised of many more processes than the average facility, and also consists of processes that are very complicated and require many steps. Thus, the cost for this particular outlier is not at all representative of the cost that the "average" facility will see. Thus, the outlier was excluded for

purposes of summarizing the typical cost to a facility. However, the outlier cost was still included for the nationwide impact analysis.

Under both Option 1 and Option 2, facilities would be required to perform a scoping study to identify potentially emitted F-GHGs in their process streams. It was estimated that two-thirds of the processes at facilities would have F-GHG emissions that exceeded the one-ton threshold for performing the study. Facilities would also be required to measure the destruction efficiency of their destruction device (e.g., thermal oxidizer) initially and every five years thereafter.

4.4.2 Cost Analysis for Mass Balance Approach - Option 1

This section identifies the costs associated with complying with the rulemaking using Option 1, the Mass Balance approach. Compliance costs for this option include both labor and non-labor (capital and O&M) costs and both startup and recurring costs. The "average" plant that utilized the mass balance approach was estimated to have a total of 4.67 processes. The total first year cost for the mass balance method is $127,440 in labor costs and $14,933 in capital costs. Tables 4-5 and 4-6 summarize the labor and non-labor costs respectively.

Initial planning costs were estimated for the time needed to review the rule and prepare required initial notifications and records. These planning hours include resolving questions, reviewing drawings, conducting source inspections, defining constraints, writing the engineering report and onetime costs for equipment leak measurement, such as walk-down and field verification, populating software and initial monitoring setup costs.

For the mass balance approach, the planning hours total to 6.4 management hours, 12.5 administrative hours and 124.9 hours for the industrial engineer/technician. Quality assurance/quality control costs for planning, meetings, sample analysis certification and annual review total 4.6 hours for the industrial manager, 92.9 industrial engineer/technician hours and 37.1 administrative hours.

Sampling, analysis, monitoring and calculation costs were estimated on a per-continuous-process basis. Existing facilities have indicated that the mass balance method is not practical for batch processes, due to higher cost and the nature of the batch processes, so costs for batch processes have not been calculated.

For the mass balance approach, stream sampling and analysis costs include 1798 hours for the industrial engineer/technician, 179.8 administrative hours and 89.9 management hours.

This includes 165 engineer/technician hours, 8.25 management hours and 16.5 administrative hours to perform the mass balance measurements and calculations for each of the 4.67 processes. It also includes 330 engineer/technician hours, 16.5 management hours and 33 administrative hours to complete the scoping study on each of the 3.1 processes above the one-ton threshold.

Recordkeeping and reporting costs were estimated to include 24.7 industrial engineer/technician hours, 5.7 management hours and 2.4 administrative hours to compile and store data annually. Labor requirements for preparing the annual report include 7.3 industrial engineer/technician hours, 0.7 management hours, and 1.7 administrative hours to prepare the annual report.

Capital costs included include $14,933 to hire a consultant to perform Destruction Efficiency Testing.

Table 4-5. Subpart L – F-Gas Mass Balance Approach: Labor Costs (2006$)

Activity	Labor Rates (per hour)								Labor Cost per Year per Reporting Unit/Facility	
	Legal		Managerial		Technical		Clerical			
	$101.00		$71.03		$55.20		$29.65			
	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning			6.4	0.0	124.9	0.0	12.5	0.0	$7,719	$0
QA/QC			4.6	1.2	92.9	23.2	37.1	9.3	$6,555	$1,638
Recordkeeping			2.4	2.4	24.7	24.7	5.7	5.7	$1,702	$1,702
Sampling and analysis (calculations)			89.9		1798.0		179.8		$110,960	$0
Reporting			0.7	0.7	7.3	7.3	1.7	1.7	$503	$503
Total	**0**	**0**	**103.99**	**4.24**	**2,047.80**	**55.20**	**236.80**	**16.70**	**$127,440**	**$3,844**

Note: All costs are in constant 2006$s.

Table 4-6. Subpart L – F-Gas Mass Balance Method: Capital and O&M Costs (2006$)

Activity	Cost Categories				Total Reporting Cost per Unit/Facility	
	Capital Cost	Equipment Lifetime (years)	Annualized Capital Cost (per year)	O&M Costs (per year)	First Year	Subseq. Year
Equipment (selection, purchase, installation)						
Performance testing	$14,993	10	$1,046		$1,046	$0
Recordkeeping and Reporting						
Travel						
Sampling costs						
Total	**$14,993**		**$1,046**	**$0**	**$1,046**	**$0**

Note: All costs are in constant 2006$s. Annualization uses 7% interest rate.

4.4.3 Cost Analysis for Option 2- Process Vent Testing

Following are all costs associated with complying with the rulemaking using Option 2, Process Vent Testing. These include both labor and non-labor (capital and O&M) costs and both startup and recurring costs. The "average" plant that utilized the process vent approach was assumed to have a total of 5 processes. An average of 2.5 process vents were assumed to be evaluated by testing. The remaining vents, accounting for 75% of the total vents at a facility, were assumed to be evaluated using the engineering calculation approach. In effect, this was assumed to require engineering calculations for each of the 5 processes at the average facility complying with the Process Vent approach.

In each of the following paragraphs, the costs are broken out between the process vent emissions estimates and the equipment leak assessment. For the average facility, the total first year labor cost for the process vent method is $99,350, and the total first year labor cost for the equipment leak measurements is $50,650. A capital cost of $22,120 per average facility is also estimated.

Initial planning costs were estimated for the time needed to review the rule and prepare required initial notifications and records. These planning hours include resolving questions, reviewing drawings, conducting source inspections, defining constraints, writing the engineering report and onetime costs for equipment leak measurement, such as walk-down and field verification, populating software and initial monitoring setup costs.

For the process vent measurements and calculations, the planning hours total to 1.8 management hours, 19 administrative hours and 37.6 hours for the industrial engineer/technician. Quality assurance/quality control costs for planning, meetings, sample analysis certification and annual review total 3.4 hours for the industrial manager, 67.8 technician hours and 34 administrative hours.

For the equipment leak assessment, the planning hours total to 50 administrative hours and 35 hours for the industrial engineer/technician.

Sampling, analysis, monitoring and calculation costs were on a per-vent basis for the process vent testing and a per-process basis for process vent calculations and for equipment leaks.

For the process vent measurements and calculations, the emissions sampling and analysis costs (including the scoping study) include 1,448.3 hours for the industrial engineer/technician,

144.8 administrative hours and 72.4 management hours. This includes 236 engineer/technician hours per process vent to perform testing on 2.5 process vents. In addition, it includes 5 engineer/technician hours for each of the 5 processes at the average facility to model the process and perform the calculations. Finally, it includes 250 engineer/technician hours, 12.5 management hours and 25 administrative hours to complete the scoping study on each of the 3.34 processes above the one-ton threshold.

For the equipment leak assessment, these costs include 800.5 industrial engineer/technician hours for the combined first year cost of the emissions test and the engineering calculations. It was assumed that facilities were already assessing leaks on half of the processes; thus, costs are incurred under the rule for the other half. A total of 307.88 engineer/technician hours per process would be required for each of the 2.6 processes required to commence leak testing under the rule. (The total number of processes assessed for equipment leaks at the average facility, 5.2, is higher than the number of processes evaluated under the process vent approach due to the slightly higher number of processes at the facilities required to assess leaks.).

Recordkeeping and reporting costs were estimated were estimated on an annual basis, requiring 24.7 industrial engineer/technician hours, 5.7 management hours and 2.4 administrative hours to compile and store data. Labor requirements for preparing the annual report included 7.3 industrial engineer/technician hours, 0.7 management hours, and 1.7 administrative hours to prepare the annual report.

For the equipment leak assessment, first year recordkeeping costs totaled 32.5 technical hours and 42.5 administrative hours to document the monitoring process, maintain records and perform administrative tasks. First year reporting costs totaled 32.5 technical hours and 42.5 administrative hours for all annual reporting associated with equipment leaks. For both recordkeeping and reporting, these costs remained constant for the second and subsequent years. These costs are halved in the table because, as noted above, half of the processes were assumed to already be monitored.

Capital costs included equipment for leak detection such as the monitoring device and data collection system. It was assumed that half of the facilities already possess monitoring and data collections systems, and that half of the facilities would be required to complete Destruction Efficiency Testing.

Capital costs for the mass balance approach included $11,200 for Destruction Efficiency Testing equipment.

Capital costs for the average facility totaled $11,340 in equipment and O&M costs associated with the equipment leaks.

Table 4-7. Subpart L – F-Gas Process Vent (Avg. per plant basis): Labor Costs (2006$)

Activity	Labor Rates (per hour)								Labor Cost per Year per Reporting Unit/Facility	
	Legal		Managerial		Technical		Clerical			
	$101.00		$71.03		$55.20		$29.65			
	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning			1.8		72.6		69.0		$6,181	$0
QA/QC			3.4	0.9	67.8	17.0	34.0	8.5	$4,992	$1,251
Recordkeeping			2.4	2.4	41.0	41.0	27.0	27.0	$3,230	$3,230
Sampling and analysis (calculations)			72.4		2248.8	138.6	144.8		$133,565	$7,649
Reporting			0.7	0.7	23.6	23.6	23.0	23.0	$2,031	$2,031
Total	**0**	**0**	**80.73**	**3.96**	**2,453.73**	**220.08**	**297.73**	**58.40**	**$149,999**	**$14,161**

Note: All costs are in constant 2006$s.

Table 4-8. Subpart L – F-Gas Process Vent Method: Capital and O&M Costs (2006$)

Activity	Cost Categories				Total Reporting Cost per Unit/Facility	
	Capital Cost	Equipment Lifetime (years)	Annualized Capital Cost (per year)	O&M Costs (per year)	First Year	Subseq. Year
Equipment (selection, purchase, installation)	$10,920	10	$765		$765	$0
Performance testing	$11,200	10	$784		$784	$0
Recordkeeping and Reporting						
Travel						
Sampling costs					$0	$2,560
Total	**$22,120**		**$1,549**	**$0**	**$1,549**	**$2,560**

Note: All costs are in constant 2006$s. Annualization uses 7% interest rate.

4.5 Cost Analysis for Subpart OO—Imports and Exports of Fluorinated GHGs

4.5.1 Model Facility Development

Importers and exporters of products containing fluorinated GHGs include manufacturers, distributors, and retailers of these products. Such products include several types of refrigeration and air-conditioning equipment and foams containing HFCs and electrical equipment containing SF_6. This analysis does not consider the costs of CO_2 and N_2O contained in imported and exported products. Although EPA does not have data on the amount of CO_2 or N_2O imported and exported in products (e.g., carbonated sodas and cans of whipped cream), the relatively small quantities of CO2 or N2O contained in each unit and the relatively low GWPs of these gases (compared to those of the fluorinated GHGs) imply that the CO_2-equivalent quantities imported are likely to be small both nationally and per importer.

There is one model entity that represents importers/exporters of products containing fluorinated GHGs and the specific reporting activities and costs.

- *Importers/Exporters of fluorinated GHG--containing products:* An entity that imports or exports products or foam containing fluorinated GHGs or equipment containing SF_6.

This entity is assumed to import or export 15 equipment types (with distinct charge sizes and possibly chemicals) in 20 shipments each year.

The proposed monitoring method for fluorinated GHGs-containing products and equipment requires the identification of the total amount of each fluorinated GHG imported/exported inside the products and/or the quantity of products imported/exported (e.g., number of pieces of equipment) along with information on the identity and quantity of the fluorinated GHG in each unit or piece. Persons importing equipment that contain both a fluorinated GHG refrigerant and a foam blown with a fluorinated GHG (e.g., household refrigerators) would separately report these GHGs (which are generally different). Similarly, total exports of chemical actually contained in exported equipment, foams, or other products would be reported by exporters, by chemical in metric tons or metric tCO2e. Trans-shipments (i.e., products containing GHGs that originate in a foreign country and enter the United States en route to an ultimate destination in another foreign country) would be exempt from reporting. Importers/exports of products containing fluorinated GHGs would report their imports/exports on the corporate level.

Table 4-9 presents the number of affected entities that would be subject to the rule based on alternative emission thresholds.

Table 4-9. Number of Representative Affected Entities Used in the Cost Analysis

Threshold	Number of Representative Entities[a]					
	All HFC Equipment		All Foam Products		All SF_6 Equipment	
	Importers	Exporters	Importers	Exporters	Importers	Exporters
1,000	50	25	50	25	8	10
10,000	50	25	50	25	8	5
25,000	50	25	50	25	8	0
100,000	50	25	50	25	8	0

[a]While listed separately in the table above to illustrate the number of importers and number of exporters, importers and exporters are the same entities for SF_6 equipment, and in some cases, the same entities for HFC equipment and foam products. As such, the per-facilities costs will increase—to reflect activities associated with both importing and exporting, and the overall number of respondents will decrease given the overlap.

4.5.2 Determine Cost Elements

The total costs associated with complying with the proposed rulemaking can be broken into 4 elements, each of which is described below.

Monitoring Costs. Costs for tracking quantities of products imported and the quantity of fluorinated GHGs in these products include first-year costs to establish a system such as a spreadsheet or database to track charge sizes for different types of equipment and the numbers of pieces of that type of equipment that are imported. Subsequent year costs include maintaining this system.

Reporting Costs. The reporting costs associated with complying include annual labor hours for reporting the quantities of products or foam imported and/or exported; and the name and quantity of fluorinated GHG within each product or foam imported and/or exported.

Record Keeping Costs. Additional and reporting ($500) costs were also added to each facility.

4.5.3 Analyze Proportion of Facilities in the Different Model Facility Categories

To classify facilities into different groups, the activities undertaken at each model facility type were evaluated. The activities conducted by each model facility are listed in the model facility development section for this subpart. Table 4-10 indicates the number of facilities that fall into each model facility category.

Table 4-10. Allocation of Facilities to Model Types

Segment	Number of Facilities
Importer of HFC-containing equipment	
	50
Exporters of HFC-containing equipment	
	25
Importer of HFC-containing foams	
	50
Exporter of HFC-containing foams	
	25
Importers of SF_6-containing equipment	
	8
Exporters of SF_6-containing equipment	
	10

4.5.4 Assigning Costs to Cost Elements

Determining Labor Categories

To evaluate labor costs, it was not only necessary to determine the amount of time required for all of the tasks associated with monitoring, but also to determine who will perform each task. For this analysis, two labor categories were used as shown in Table 4-11.

Table 4-11. Labor Categories and Hourly Rates

Labor Category	Description	Loaded Hourly Rate (2006$/hour)
Managerial	Oversees work at a high level and is the final authority on all reporting requirements.	$71.03/hour
Technical	Conducts monitoring of emissions sources, checks for accuracy, performs measurements.	$55.20/hour

Allocating Responsibilities and Estimate Labor Hours

Assigning labor hours for all cost elements was based on the following approach.

To determine hours for the first year, the time to assemble relevant paperwork for the first year was taken into account, as well as the time to develop a listing of equipment types and foam products, and the time to enter in the data for all equipment types across all shipments.

To determine hours for subsequent years, the time to maintain the ongoing, relevant paperwork was taken into account as well as the time to enter in the data for all equipment types across all shipments. Management time in both the first and subsequent years was assumed to represent 10 percent of total time for both the first and subsequent years. .

Table 4-12 summarizes the allocation of hours and responsibilities by labor category. The reporting labor hours shown in this table represent the time estimated to complete the cost element for all activities applicable to the entity (i.e., import, export).

Table 4-12. Responsibilities for Regulation Compliance by Labor Category

Cost Element	Responsibilities and Hours by Labor Category				
	Managerial		Technical		Per Facility/ Per Company*
	Responsibilities	Hours	Responsibilities	Hours	
Importer/Exporter of Fluorinated GHG-containing Product (including foams and SF_6-containing equipment)					
Registration Compliance Data					
None Estimated					
Monitoring					
First Year: Tracking System	To oversee the design of a database or spreadsheet to track imports/exports	4	To establish a database or spreadsheet to track imports/exports	40	Per Company
Subsequent Years: *Tracking System*	To review maintained tracking system	3	To update and maintain tracking system	31	Per Company
Reporting					
Report Data	To review the data	1	To collect data records already measured by an instrument	3	Per Company
Record Keeping					
None Estimated					

Once the labor hours were calculated, by category, for each of the cost elements, they were multiplied by the associated labor rates to estimate labor costs per facility. No additional costs are assumed.

Capital Cost Annualization and O&M Costs

There are no assumed capital costs related to monitoring emissions and archiving of information, and therefore there are no associated O&M costs.

4.5.5 Estimate per Facility Costs for Each Threshold Level

Once the labor hours were calculated, by category, for each of the cost elements (as shown in Table 4-12, they were multiplied by the associated labor rates (as shown in Table 4-11) to estimate labor costs per facility. The unit cost per entity was multiplied by the number of

facilities that exceed the reporting threshold (as shown in Table 4-10), to determine the total national costs per year for this sector.

4.5.6 Subpart SS—Electrical Equipment Manufacturing

4.5.6.1 Model Facility Development

The model facility for electrical equipment manufacture or refurbishment and manufacturing of electrical components is a manufacturer that produces an average amount (nameplate capacity) of SF_6-containing transmission and distribution equipment. Costs are not expected to vary widely among electrical equipment manufacturers because all manufacturers would track the same set of quantities (SF_6 stored, acquired, and disbursed), and the costs of tracking and reporting these quantities are relatively modest.

The model facility is assumed to already have the capital and technical capability to monitor and report emissions of SF_6 using a mass-balance formula. To use the formula, facilities must track their SF_6 inventory in cylinders, SF_6 acquisitions, and SF_6 disbursements. These data are already tracked by electrical equipment manufacturers, but not necessarily as closely and comprehensively as required to develop all manufacturer-level mass-balance inputs. Thus, as discussed below, the model facility is assumed to incur some costs for tracking and reporting SF_6 emissions.

Table 4-13 presents the number of affected entities that would be subject to the rule based on alternative emission thresholds under subpart SS.

Table 4-13. Number of Representative Affected Entities Used in the Cost Analysis

Threshold	Number of Representative Entities
1,000	10
10,000	10
25,000	10
100,000	5

4.5.6.2 Determine Cost Elements

The total costs associated with the proposed rulemaking for electrical equipment manufacturers were estimated using labor hours from an Information Collection Request (ICR)

performed for EPA's SF_6 Emission Reduction Partnership.[9,10] The labor hours were multiplied by current labor costs to calculate the reporting costs under the proposed reporting rule. All labor costs are considered on an annual basis and are divided into the following four categories:

Regulation Compliance Determination Costs. Recurring costs consist of reviewing the instructions of the mass-balance reporting form and associated materials to ensure the proper procedures are in place to obtain technically accurate inputs.

Monitoring Costs. Recurring costs consist of gathering information for the mass-balance reporting form and associated materials. The information gathered represents the movement of SF_6 throughout the system.

Reporting Costs. Recurring costs consist of completing and reviewing the information requested by the mass-balance reporting form and associated materials as well as submitting all materials.

Recordkeeping Costs. Recurring costs consist of maintaining a record of the emissions inventory and documentation.

4.5.6.3 Analyze Proportion of Facilities in the Different Model Facility Categories

There is only one model facility for electrical equipment manufacture or refurbishment and manufacturing of electrical components.

4.5.6.4 Assigning Costs to Cost Elements

Determining Labor Categories

To evaluate labor costs, it was not only necessary to determine the amount of time required for all of the tasks associated with monitoring, but also to determine who will perform each task. For this analysis, two labor categories were used as shown in Table 4-14.

[9] EPA. (2000). Supporting statement for EPA Information Collection Request number 1933.01 "Information collection activities associated with EPA's SF_6 Emission Reduction Partnership for Electric Power Systems"

[10] Although the ICR was focused on the costs of reporting SF_6 emissions from electric utilities rather than electrical equipment manufacturers, the inputs required to calculate emissions and the activities involved with reporting are similar for both sectors. Therefore, the costs incurred for electrical equipment manufacturers are assumed to be the same as the costs incurred for electric power systems.

Table 4-14. Labor Categories and Hourly Rates

Labor Category	Description	Loaded Hourly Rate ($/hour)
Managerial	Oversees work at a high level and is the final authority on all reporting requirements. Reviews reporting forms to ensure accuracy and consistency	$71.03/hour
Technical	Compiles data to develop mass-balance inputs. Performs emission calculations on reporting form	$55.20/hour
Clerical	Assists with documentation and recording information	$29.65/hour

Allocating Responsibilities

Labor hours for all cost elements were estimated based on consultation between EPA and SF_6 Emission Reduction Partners conducted for the 2000 Partnership ICR. Table 4-15 summarizes the allocation of hours and responsibilities by labor category.

Table 4-15. Responsibilities for Regulation Compliance by Labor Category Per Facility

Cost Element	Responsibilities and Hours by Labor Category					
	Managerial		Technical		Clerical	
	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours
Regulation Compliance Determination Costs						
Review the instructions, SF_6 mass-balance reporting form, and associated materials	Review the instructions to the level required to perform oversight responsibilities	1	Review the instructions to the level required to compile data and perform necessary calculations	1.5		0
Monitoring Costs						
Gather information for the SF_6 mass-balance reporting form and associated materials	Institute and oversee proper data collection procedures that account for all SF_6 within the system	4	Compile SF_6 data and sort data into appropriate input categories for the mass-balance formula	17	Perform measurements and collect documentation that track SF_6 gas movements	11
Reporting Costs						
Complete and review the information requested by the SF_6 mass-balance reporting form and associated materials	Review reporting forms to ensure accuracy and consistency	3.5	Calculate inputs for the mass-balance reporting form. Perform facility-wide SF_6 emission calculations	3.5	Provide data and supporting documentation to technical and managerial staff	1.5
Submit the SF_6 mass-balance reporting form and associated materials		0		0	Combine the mass-balance reporting form with all necessary materials and submit	0.2
Recordkeeping Costs						
Maintain a record of the emissions inventory and documentation		0		0	File the mass-balance reporting form and associated materials into the recordkeeping system	0.2

4.5.7 Other Costs

Other costs consist of postage costs—for submitting materials in a one ounce package, and photocopying costs—for maintaining records of the reporting form and associated materials. These costs were gathered by EPA in the SF_6 Emission Reduction Partnership ICR and are presented in Table 4-16.

Table 4-16. Other Costs Associated with Reporting and Recordkeeping

Element	Description	Costs ($)
Postage Costs	Postage costs for submitting the reporting form and associated materials	$0.38
Photocopying Costs	Photocopying costs for maintaining a record of the emissions inventory and associated materials	$11.66

4.5.7.1 Estimate per Facility Costs for Each Threshold Level

Once the labor hours were calculated, by category, for each of the cost elements, they were multiplied by the associated labor rates to estimate labor costs per facility. Other costs, consisting of postage and photocopying, were then added to the labor costs to calculate the total cost per facility. For calculating national costs, the total cost per facility was multiplied by 10, which is the number of facilities that exceed the reporting threshold.

4.6 Public Sector Burden

EPA estimates the public sector burden to be $383,582 per year; $72,000 per year is for verification activities, and remaining costs are for program implementation and developing and maintaining the data collection system. Program implementation activities include, but are not limited to, developing guidance and training materials to assist the regulated community, responding to inquires from affected facilities on monitoring and applicability requirements, and developing tools to assist in determining applicability.

SECTION 5
ECONOMIC IMPACT ANALYSIS

EPA has prepared an EIA to provide decision makers with a measure of the social costs of using resources to comply with the proposed GHG reporting requirements. As noted in EPA's (2000) *Guidelines for Preparing Economic Analyses*, several tools are available to estimate social costs and range from simple direct compliance cost methods to the development of a more complex market analysis that estimates market changes (e.g., price and consumption) and economic welfare changes (e.g., changes in consumer and producer surplus). Given data limitations and the size scope of the proposed rule, EPA has used the direct compliance cost method as a measure of social costs.

5.1 Selection of Reporting Thresholds

5.1.1 Subpart I- Electronics Manufacturing

In the initial proposal, EPA proposed capacity-based thresholds equivalent to 25,000 metric tons of CO_2e for manufacture of semiconductors, LCDs, and MEMS, and an emissions-based threshold of 25,000 metric tons of CO_2e for manufacture of PV. As stated in the initial proposal, EPA proposed to use a capacity-based threshold based on the published capacities of facilities, as opposed to an emissions-based threshold, where possible, because EPA believed that it simplified the applicability determination. In comments received in response to the initial proposed rule, several comments indicated that the proposed capacity-based threshold created ambiguity. In response to the comments received on the initial proposed capacity-based threshold, EPA is now proposing an emissions-based threshold of 25,000 mtCO_2e for manufacture of semiconductors, LCD, MEMS, and PV.

In the analysis, EPA considered emission thresholds of 1,000 metric tons CO_2e, 10,000 metric tons CO_2e, 25,000 metric tons CO_2e, and 100,000 metric tons CO_2e per year. This analysis used IPCC Tier 1 emission factors and assumed no abatement. Table 5-1 presents the emissions and facilities that would be captured by the respective emissions thresholds.

Table 5-1. Threshold Analysis for Subpart I – Electronics Manufacturing Industry

Emission Threshold Level (metric tons CO_2e/yr)	Total National Emissions (metric tons CO_2e/yr)	Total Number of Facilities	Emissions Covered		Facilities Covered	
			metric tons CO_2e/yr	Percent	Facilities	Percent
1,000	5,984,463	216	5,962,091	99.6%	165	76%
10,000	5,984,463	216	5,813,200	97%	114	53%
25,000	5,984,463	216	5,622,570	94%	94	44%
100,000	5,984,463	216	4,737,622	79%	55	26%

EPA selected the 25,000 metric tons CO_2e per year threshold because this threshold maximizes emissions reporting, while excluding small facilities that do not contribute significantly to the overall GHG emissions.

The proposed emissions-based thresholds are estimated to include approximately 50 percent of semiconductor facilities and between approximately 0 percent and 17 percent of the facilities manufacturing MEMS and PV respectively (see Table 5-2). At the same time, the thresholds are expected to cover nearly 96 percent of fluorinated GHG emissions from semiconductor facilities, 66 percent of fluorinated GHG emissions from facilities manufacturing MEMS, and 47 percent of fluorinated GHG emissions from facilities manufacturing PV.

Table 5-2. Summary of Rule Applicability under the Proposed Emission-Based Thresholds for Subpart I – Electronics Manufacturing Industry

Emission Threshold Level (metric tons CO_2e/yr)	Total National Emissions (metric tons CO_2e/yr)	Total Number of Facilities	Total Emissions of Source (metric tons CO_2e)	Emissions Covered		Facilities Covered	
				metric tons CO_2e/yr	Percent	Facilities	Percent
Semicon-ductors	25,000	175	5,741,676	5,492,066	96%	91	52%
MEMS	25,000	12	146,115	96,164	66%	2	17%
LCD	25,000	9	23,632	0	0%	0	0%
PV	25,000	20	73,039	34,340	47%	1	5%

Combined these emissions are estimated to account for close to 94 percent of fluorinated GHG emissions from the electronics industry as a whole. Facilities manufacturing LCDs are not

expected to be covered by the proposed threshold. To determine whether a manufacturer falls above or below the proposed 25,000 metric tons of CO_2e, EPA is proposing that semiconductor, MEMS, and LCD facilities use gas specific 2006 IPCC Tier 1 emission factors assuming 100% manufacturing capacity to calculate annual metric tons of emissions in CO_2 equivalents. For PV facilities, EPA is proposing that they facilities multiply annual fluorinated GHG purchases or consumption by the gas-appropriate 100-year GWPs, as defined in Table A-1 to Subpart A of Part 98, to calculate annual metric tons of emissions in CO_2 equivalents. None of these calculations shall account for emission abatement technologies.

When abatement equipment is used, electronics manufacturers often estimate their emissions using the manufacturer-supplied DRE for the equipment. However, abatement equipment may fail to achieve its rated DRE either because it was not installed properly, is not being properly operated and maintained, or because the DRE value itself was incorrectly measured due to a failure to properly account for the effects of dilution. For example, reported DREs for CF_4 can be overstated by as much as a factor of 20 to 50, and the corresponding figure for C_2F_6 can be overstated by a factor of up to 10 because of failure to properly account for dilution (Burton, 2007). Regardless of the reason, actual emissions from facilities employing abatement equipment may exceed estimates when based on the manufacturers' rated DREs of this equipment and may therefore exceed the 25,000 metric tons CO_2e threshold without the knowledge of the facility operators.

For additional background information on the threshold analysis, refer to the Electronics Manufacturing TSD (EPA-HQ-OAR-2009-0927). For specific information on costs, including unamortized first year capital expenditures, please refer to section 4.3.

5.1.2 Subpart L- Fluorinated Gas Production

Under the proposed rule, owners and operators of fluorinated gas production facilities would be required to estimate and report GHG emissions if those emissions, including both combustion and fluorinated GHG emissions, would exceed 25,000 mtCO2e in the absence of control technology (e.g., thermal oxidation)[11].

[11] Following the precedents set by other Clean Air Act regulations, EPA is using the term "uncontrolled" to describe such emissions. Specifically, EPA is proposing to define "uncontrolled fluorinated GHG emissions" as a gas stream containing fluorinated GHG which has exited the process (or process condenser, where applicable), but which has not yet been introduced into an air pollution control device to reduce the mass of fluorinated GHGs in

In developing the threshold, we considered multiple controlled and uncontrolled emissions thresholds, including 1,000, 10,000, 25,000, and 100,000 metric tons CO_2e. For fluorinated GHG production processes (including fluorinated anesthetics production processes), uncontrolled (pre-control) emissions were estimated by multiplying a factor of 3 percent by the estimated production at each facility. For CFC and HCFC production processes (except for HCFC-22 production processes), uncontrolled emissions were estimated by multiplying a factor of 2 percent by the estimated production at each facility. Uncontrolled emissions are strongly influenced by by-product generation rates, which are known to vary between zero and several percent for fluorinated gas production processes; thus, these estimates are uncertain. Controlled emissions were assumed to be half of uncontrolled emissions at each facility. Because EPA has little information on combustion-related emissions at fluorinated gas production facilities, these emissions were not included in the analysis. The results of the analysis for production of HFCs, PFCs, SF_6, NF_3, CFCs, and HCFCs are shown in Tables L-1 and L-2.

Table 5-3 Threshold Analysis for Fluorinated GHG Emissions from Production of HFCs, PFCs, SF6, NF3, CFCs, and HCFCs (Uncontrolled Emissions)

Threshold Level (metric tons CO_2e/r)	Total National Emissions (metric tons CO_2e)	Number of Facilities	Emissions Covered		Facilities Covered	
			Metric tons CO2e	Percent	Number	Percent
1,000	10,600,000	14	10,600,000	100%	14	100%
10,000	10,600,000	14	10,600,000	100%	14	100%
25,000	10,600,000	14	10,600,000	100%	14	100%
100,000	10,600,000	14	10,600,000	100%	13	93%

the stream. The term does not imply that the emissions are never controlled, but is synonymous with "pre-control emissions."

Table 5-4. Threshold Analysis for Fluorinated GHG Emissions from Production of HFCs, PFCs, SF6, NF3, CFCs, and HCFCs (Controlled Emissions)

Threshold Level (metric tons CO_2e/r)	Total National Emissions (metric tons CO_2e)	Number of Facilities	Emissions Covered		Facilities Covered	
			Metric tons CO2e	Percent	Number	Percent
1,000	10,600,000	14	10,600,000	100%	14	100%
10,000	10,600,000	14	10,600,000	100%	14	100%
25,000	10,600,000	14	10,600,000	100%	14	100%
100,000	10,600,000	14	10,300,000	97%	10	71%

As can be seen from the tables, most HFC, PFC, SF_6, NF_3, CFC, and HCFC production facilities would be covered by all the thresholds considered. Although we do not have facility-specific production information for producers of fluorinated anesthetics, we believe that few or none of these facilities are likely to have uncontrolled emissions above the proposed threshold.

EPA is proposing to use a threshold based on uncontrolled (pre-control) rather than controlled (post-control) emissions to ensure that facilities that generate significant quantities fluorinated GHGs fully characterize and quantify their emissions, even if they initially believe those emissions to be small. Discussions with fluorinated gas manufacturers indicate that occasionally, fluorinated GHG by-products may be generated and emitted from production processes unexpectedly. If these by-products are relatively difficult to destroy (e.g., CF_4), facilities' post-control emissions may be significantly higher than expected.[12] The initial scoping test described in the next section is intended to identify the full range of fluorinated GHGs in potentially emitted streams. Applying the full methodologies on the basis of the initial scoping study will provide EPA and the facilities with critical information on the extent to which control technologies are actually reducing emissions and therefore on the actual emissions from the facility.

[12]It is important to note that even if a threshold based on controlled emissions were adopted, failure to report as required when a source's actual emissions were above that threshold would be a violation of these regulations and the Clean Air Act. Lack of test data or other errors of omission do not excuse such violations as the Clean Air Act is a strict liability statute

EPA is requesting comment on an alternative approach in which all fluorinated gas production facilities, regardless of their estimated pre-control emissions, would analyze their emissions using the initial scoping test discussed in the next section. This approach would ensure that facilities understood the identities, and therefore the GWPs, of the fluorinated GHGs potentially emitted. EPA requests comment on this option, as well as on the option of simply eliminating the threshold for fluorinated gas production facilities and making this an "all-in" category.

As is true for the source categories covered by the Final MRR, fluorinated GHG production facilities could cease reporting if their controlled (post-control) emissions were less than 25,000 mtCO2e per year for five consecutive years or less than 15,000 mtCO2e per year for three consecutive years. This approach may be appropriate if control technologies are effective and there is no evidence of unexpected uncontrolled emissions. However, EPA requests comment on an alternative "off-ramp" for this source category. Under this alternative approach, the 25,000 and 15,000 mtCO2e triggers would be based on the level of emissions that is estimated before accounting for the use of any control technology (e.g., thermal oxidation). EPA is requesting comment on this approach because emissions can become quite large if the destruction device malfunctions, is not operated properly, or is not used for some other reason.

As noted above, EPA estimates that under this proposal, all HFC, PFC, SF_6, and NF_3 production facilities would be covered, and few or no anesthetics producing facilities would be covered. However, it is possible that EPA has underestimated total pre-control emissions from anesthetics. In its threshold analysis for fluorinated GHG production, EPA has assumed that emissions have GWPs similar to those of the product produced. However, fluorinated anesthetics are hydrofluoroethers, and other HFE production processes of which EPA is aware generate by-products with higher GWPs than the product. EPA requests comment on this issue.

5.1.3 A full discussion of the threshold selection analysis is available in the revised Fluorinated GHG Production TSD (EPA-HQ-OAR-2009-0927-012). For specific information on costs, including unamortized first year capital expenditures, please refer to Economic Analysis (EA) for this rulemaking. Subpart OO- Imports and Exports of Fluorinated GHGs in Pre-Charged Equipment and Closed-Cell Foams

Under the current proposal, EPA is proposing to require that importers and exporters of F-GHGs contained in pre-charged equipment and closed cell foams report their imports and

exports if either their total imports or their total exports, in equipment, foams, and in bulk, exceed 25,000 $mtCO_2e$ per year. This threshold is the same as that for bulk imports and exports.

Table 5-5. Threshold Analysis for Subpart OO–Imports of Fluorinated GHGs in Pre-Charged Equipment and Closed-Cell Foams

	HFC Refrigeration/AC Equipment		SF_6 Electrical Equipment		Closed-cell Foams	
Threshold Level	**Imports Covered**	**Importers Covered**	**Imports Covered**	**Importers Covered**	**Imports Covered**	**Importers Covered**
1,000	15,733,523	50	1,888,932	8	3,025,285	50
10,000	15,733,523	50	1,888,932	8	3,025,285	50
25,000	15,733,523	50	1,888,932	8	3,025,285	50
100,000	15,733,523	50	1,888,932	8	0	50

Table 5-6. Threshold Analysis for Subpart OO–Exports of Fluorinated GHGs in Pre-Charged Equipment and Closed-Cell Foams

	HFC Refrigeration/AC Equipment		SF_6 Electrical Equipment		Closed-cell Foams	
Threshold Level	**Exports Covered**	**Exporters Covered**	**Exports Covered**	**Exporters Covered**	**Exports Covered**	**Exporters Covered**
1,000	5,247,905	25	153,323	10	3,025,285	25
10,000	5,247,905	25	107,326	5	3,025,285	25
25,000	5,247,905	25	0	0	3,025,285	25
100,000	5,247,905	25	0	0	3,025,285	25

5.1.4 Subpart SS- Electrical Equipment Manufacture or Refurbishment and Manufacturing of Electrical Components

EPA is proposing to require electrical equipment manufacturers to report their SF_6 and PFC emissions if their total annual purchases of SF_6 or PFCs exceed 23,061 lbs. This consumption-based threshold is equivalent to an emissions-based threshold of 25,000 $mtCO_2e$, assuming an average manufacturer emission rate of 10%. EPA chose the consumption-based threshold, as it is believed to allow equipment manufacturers to quickly determine if they are subject to reporting requirements by referencing their SF_6 purchase records.

Table 5-7. Threshold Analysis for Subpart SS– Electrical Equipment Manufacture or Refurbishment and Manufacturing of Electrical Components

Emission Threshold (Mt CO_2 Eq)	**1,000**	**10,000**	**25,000**	**100,000**
Consumption Threshold (lbs. of SF_6)	**922**	**9,220**	**23,061**	**92,244**
Number of Facilities Above	10	10	10	5
Percent of Facilities Above	100%	100%	100%	50%
Total Emissions of Facilities Above (Mt CO_2 Eq)	814,128	814,128	814,128	569,890
Percent of Emissions Above	100%	100%	100%	70%

5.1.5 National Emissions Covered Under Selected Thresholds

The total national emissions covered under the selected options are 46 $MtCO_2e$ (Table 5-8). The majority of these covered emissions are from the importers and exporters of fluorinated GHGs covered by Subpart OO (28.9 $MtCO_2e$). Although the majority of cost and emissions information reported in this economic and small entity analysis is organized by subpart, EPA also mapped each subpart to an industry included in the North American Industry Classification System (NAICS); the mapping allows the cost data to be used in conjunction with other economic census data.

Table 5-8. Estimates of Emissions ($MtCO_2e$) Reported in 2008 Under the Selected Option

Subpart	Emissions Coverage ($MtCO_2e$)
Subpart I - Electronics Industry	5.6
Subpart L - Fluorinated Gas Production	10.6
Subpart OO - Imports and Exports of Fluorinated GHGs	28.9
Subpart SS - Electrical Equipment Manufacture or Refurbishment and Manufacturing of Electrical Components	0.8
Total	**46.0**

5.2 National Cost Estimates

As shown in Table 5-10, the total national costs for the selected option are estimated to be $6.1 million in the first year and $3.9 million in subsequent years ($2006). This includes a public sector burden estimate of $384,000 for program implementation and verification

activities. Subparts bearing the greatest share of the ongoing private costs of the rule are the electronics industry (67%) fluorinated gas producers (23%).

In addition to total national costs by subpart under the selected option, we also report average cost per ton to support additional analysis of the mandatory reporting programs. The average ongoing (subsequent year) private cost per metric ton varies by subpart; measures range from less than $0.01 per ton (Subpart SS) to $0.45 per ton (Subpart I).

Table 5-9. National Cost Estimates by Subpart: Selected Option

		First Year			Subsequent Years		
Subpart	**2007 NAICS**	**Millions 2006$**	**$/ton**	**Share**	**Millions 2006$**	**$/ton**	**Share**
Subpart I - Electronics Industry	334111, 334413, 334119	$2.9	$0.51	47%	$2.6	$0.45	67%
Subpart L - Fluorinated Gas Production	325120	$2.1	$0.20	35%	$0.3	$0.03	7%
Subpart OO - Imports and Exports of Fluorinated GHGs	326140, 326150, 333415, 335313, 336391, 423610, 423620, 423720, 421730, 421740, 443111, 443112, 424610	$0.7	$0.02	12%	$0.6	$0.02	16%
Subpart SS - Electrical Equipment Manufacture and Refurbishment and Manufacturing of Electrical Components	33361, 33531	$0.02	$0.01	0.4%	$0.02	$0.01	1%
Private Sector, Total		$5.7		94%	$3.5		90%
Public Sector, Total		$0.4		6%	$0.4		10%
Total		$6.1		100%	$3.9		100%

5.2.1 Additional National Cost Analysis

5.2.1.1 Subpart I: Validating the DRE of Abatement Devices

Under the proposed rule, any facility that wishes to reflect abatement of fluorinated GHGs in its emissions estimates would be required to assure proper equipment installation,

operation, and maintenance and either use EPA published DRE default values or obtain verified class-specific DRE measurements to quantify the emission reductions. EPA developed a cost estimate based on an assumption that only the 23 large facilities that participate in EPA's PFC Reduction/Climate Partnership for the Semiconductor Industry use abatement devices and would incur costs for verifying the DREs of these devices. Table 5-10 illustrates the range of incremental total private costs assuming the facilities report abatement activities.

Table 5-10. Additional Subpart I Private Cost Estimates: Validating the DRE of Abatement Devices

DRE Option	DRE Option Costs ($/entity): First and Subsequent Year	Number of Affected Entities Reporting Abatement Activities	Additional Private Cost ($/entity): First and Subsequent Year	National Cost Estimate with DRE Option First Year (Millions $2006)	National Cost Estimate with DRE Option Subsequent Years (Millions $2006)
Semi-conductors (DRE Default Value Option)	$1,766	23	$40,618	$7.2	$4.0
Semi-conductors (DRE Measurement Option)	$71,766	23	$1,650,618	$8.9	$5.7

5.3 Economic Impact Analysis

EPA assessed how the regulatory program may influence the profitability of companies by comparing the monitoring program costs to total sales (i.e., a "sales" test). The techniques and data we use are identical to the MRR rule and focus on small entities. We provide additional details of the analysis below.

5.3.1 Assessing Economic Impacts on Small Entities

The first step in this assessment was to determine whether the rule will have a significant impact on a substantial number of small entities (SISNOSE). To make this determination, EPA used a screening analysis that allows us to indicate whether EPA can certify the rule as not having a SISNOSE. The elements of this analysis included

- identifying affected subparts and entities,
- selecting and describing the measures and economic impact thresholds used in the analysis, and
- determining SISNOSE certification category.

5.3.1.1 Identify Affected Subparts and Entities

The industry subparts covered by the rule were identified during the development of the cost analysis for the reporting rule. The SUSB data provide national information on the

distribution of economic variables by industry and size. These data were developed in cooperation with, and partially funded by, the Office of Advocacy of the Small Business Administration (SBA) (SBA, 2008a). The data include the number of establishments (Table 5-11), and receipts (Table 5-12) and present information on *all* entities in an industry covered by the rule; however, many of these entities would not be expected to report under the preferred option because they would fall below the 25,000 hybrid threshold. SUSB also provides this data by enterprise employment size. The census definitions in this data set are as follows:

- *establishment*: An establishment is a single physical location where business is conducted or where services or industrial operations are performed.

- *employment*: Paid employment consists of full- and part-time employees, including salaried officers and executives of corporations, who were on the payroll in the pay period including March 12, 2002. Included are employees on sick leave, holidays, and vacations; not included are proprietors and partners of unincorporated businesses.

- *receipts*: Receipts (net of taxes) are defined as the revenue for goods produced, distributed, or services provided, including revenue earned from premiums, commissions and fees, rents, interest, dividends, and royalties. Receipts exclude all revenue collected for local, state, and federal taxes.

- *enterprise*: An enterprise is a business organization consisting of one or more domestic establishments that were specified under common ownership or control. The enterprise and the establishment are the same for single-establishment firms. Each multi-establishment company forms one enterprise—the enterprise employment and annual payroll are summed from the associated establishments. Enterprise size designations are determined by the summed employment of all associated establishments.

Because the SBA's business size definitions (SBA, 2009c) apply to an establishment's "ultimate parent company," we assume in this analysis that the "enterprise" definition above is consistent with the concept of ultimate parent company that is typically used for Small Business Regulatory Enforcement Fairness Act (SBREFA) screening analyses and the terms are used interchangeably. We also report the SBA size standard(s) for each industry group in order to facilitate comparisons and different thresholds.

Table 5-11. Number of Establishments by Affected Industry and Enterprise[a] Size: 2002

					Owned by Enterprises with:					
2007 NAICS	NAICS Description	Subpart	SBA Size Standard (effective August 22, 2008)	Total Estab-lishments	1 to 20 Employees	20 to 99 Employees	100 to 499 Employees	500 to 749 Employees	750 to 999 Employees	1,000 to 1,499 Employees
334111	Electronic Computer Manufacturing	I	1,000	486	257	84	36	3	2	3
334413	Semiconductor and Related Device Manufacturing	I	1,000	1,098	458	220	138	19	19	16
334119	Other Computer Peripheral Equipment Manufacturing	I	1,000	815	411	169	85	17	7	11
325120	Industrial Gas Manufacturing	L	1,000	551	45	20	20	NA	30	55
326140	Polystyrene Foam Product Manufacturing	OO	500	551	176	123	85	16	1	20
326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing	OO	500	610	192	133	73	19	8	3
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing	OO	750	840	303	187	87	10	25	20
335313	Switchgear and Switchboard Apparatus Manufacturing	OO	750	563	273	105	46	6	NA	10
336391	Motor Vehicle Air-Conditioning Manufacturing	OO	750	72	34	17	8	NA	1	1
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers	OO	100	14,337	7,458	1,679	1,016	248	113	87

423620	Electrical and Electronic Appliance, Television, and Radio Set Merchant Wholesalers	OO	100	3,510	2,156	554	189	19	39	72
423720	Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers	OO	100	5,144	2,871	720	455	134	21	16
423730	Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers	OO	100	5,598	2,394	929	654	213	52	355
423740	Refrigeration Equipment and Supplies Merchant Wholesalers	OO	100	1,482	724	271	193	4	28	29
443111	Household Appliance Stores	OO	$9 M	10,002	7,628	806	312	NA	73	1
443112	Radio, Television and Other Electronics Stores	OO	$9 M	24,226	11,181	1,760	1,230	38	75	328
424610[b]	Plastics Materials and Basic Forms and Shapes Merchant Wholesalers	OO	100	3,717	2,238	518	281	26	20	58
33361	Engine, Turbine, and Power Transmission Equipment Manufacturing	SS	500 - 1,000	922	375	208	94	14	11	12

[a] The Census Bureau defines an enterprise as a business organization consisting of one or more domestic establishments that were specified under common ownership or control. The enterprise and the establishment are the same for single-establishment firms. Each multi-establishment company forms one enterprise—the enterprise employment and annual payroll are summed from the associated establishments. Enterprise size designations are determined by the summed employment of all associated establishments.

Since the SBA's business size definitions (http://www.sba.gov/size) apply to an establishment's ultimate parent company, we assume in this analysis that the enterprise definition above is consistent with the concept of ultimate parent company that is typically used for Small Business Regulatory Enforcement Fairness Act (SBREFA) screening analyses.

[b] The 2002 SUSB data uses 1997 NAICS codes. For this industry, the relevant code is NAICS 422610.

Table 5-12. Receipts by Affected Industry and Enterprise[a] Size ($2002 Million)

					Owned by Enterprises with:					
NAICS	NAICS Description	Subpart	SBA Size Standard (effective August 22, 2009)	Total Estab-lishments	1 to 20 Employees	20 to 99 Employees	100 to 499 Employees	500 to 749 Employees	750 to 999 Employees	1,000 to 1,499 Employees
334111	Electronic Computer Manufacturing	I	1,000	47,806	272	766	1,271	NA	NA	NA
334413	Semiconductor and Related Device Manufacturing	I	1,000	63,779	701	1,755	3,711	775	2,593	1,434
334119	Other Computer Peripheral Equipment Manufacturing	I	1,000	18,135	642	1,680	2,712	1,405	247	1,372
325120	Industrial Gas Manufacturing	L	1,000	5,780	22	292	71	NA	NA	NA
326140	Polystyrene Foam Product Manufacturing	OO	500	6,330	209	623	689	NA	NA	539
326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing	OO	500	7,170	307	772	1,063	288	NA	NA
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing	OO	750	24,699	409	1,460	1,813	348	980	803
335313	Switchgear and Switchboard Apparatus Manufacturing	OO	750	8,593	347	641	826	NA	NA	NA
336391	Motor Vehicle Air-Conditioning Manufacturing	OO	750	3,396	31	72	NA	NA	NA	NA
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers	OO	100	93,524	21,850	16,229	9,690	1,648	1,339	766

423620	Electrical and Electronic Appliance, Television, and Radio Set Merchant Wholesalers	OO	100	68,255	9,640	10,388	10,577	2,418	1,805	4,291
423720	Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers	OO	100	31,668	8,304	12,322	4,156	686	247	51
423730	Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers	OO	100	25,599	5,426	5,075	3,551	613	526	NA
423740	Refrigeration Equipment and Supplies Merchant Wholesalers	OO	100	5,014	1,333	1,791	581	14	187	NA
443111	Household Appliance Stores	OO	$9 M	12,619	5,432	2,801	1,354	NA	NA	NA
443112	Radio, Television and Other Electronics Stores	OO	$9 M	53,557	6,325	3,510	1,612	NA	NA	NA
424610[b]	Plastics Materials and Basic Forms and Shapes Merchant Wholesalers	OO	100	32,648	7,345	5,785	4,091	614	687	338
33361	Engine, Turbine, and Power Transmission Equipment Manufacturing	SS	500 - 1,000	37,701	429	1,326	2,067	309	333	304

[a] The Census Bureau defines an enterprise as a business organization consisting of one or more domestic establishments that were specified under common ownership or control. The enterprise and the establishment are the same for single-establishment firms. Each multi-establishment company forms one enterprise—the enterprise employment and annual payroll are summed from the associated establishments. Enterprise size designations are determined by the summed employment of all associated establishments.

Since the SBA's business size definitions (http://www.sba.gov/size) apply to an establishment's ultimate parent company, we assume in this analysis that the enterprise definition above is consistent with the concept of ultimate parent company that is typically used for Small Business Regulatory Enforcement Fairness Act (SBREFA) screening analyses.

[b] The 2002 SUSB data uses 1997 NAICS codes. For this industry, the relevant code is NAICS 422610.

5.3.1.2 Develop Small Entity Economic Impact Measures

Because the rule covers a large number of subparts and primarily covers businesses, the analysis generated a set of sales tests (represented as cost-to-receipt ratios)[13] for NAICS codes associated with the affected subparts. Although the appropriate SBA size definition should be applied at the parent company (enterprise) level, data limitations allowed us only to compute and compare ratios for a *model establishment* for six *enterprise size* ranges (i.e., all categories, enterprises with 1 to 20 employees, 20 to 99 employees, 100 to 499 employees, 500 to 999 employees, and 1,000 to 1,499 employees. This approach allows us to account for differences in establishment receipts between large and small enterprises and differences in small business definitions across affected industries. It is also a conservative approach, because an establishment's parent company (the "enterprise") may have other economic resources that could be used to cover the costs of the reporting program.

These sales tests examine the average establishment's total annualized mandatory reporting costs to the average establishment receipts for enterprises within several employment categories[14] (first year costs: Table 5-13; subsequent year costs: Table 5-14). The average entity costs used to compute the sales test are the same across all of these enterprise size categories. As a result, the sales-test will overstate the cost-to-receipt ratio for establishments owned by small businesses, because the reporting costs are likely lower than average entity estimates provided by the engineering cost analysis.

[13]The following metrics for other small entity economic impact measures (if applicable) would potentially include
- Small governments (if applicable): "Revenue" test; annualized compliance cost as a percentage of annual government revenues
- Small non-profits (if applicable): "Expenditure" test; annualized compliance cost as a percentage of annual operating expenses

[14]For the one to 20 employee category, we exclude SUSB data for enterprises with zero employees. These enterprises did not operate the entire year.

Table 5-13. Establishment Sales Tests by Industry and Enterprise[a] Size: First Year Costs

2007 NAICS	NAICS Description	Sub-part	SBA Size Standard (effective August 22, 2008)	Average Cost Per Entity ($/entity)	All Enter-prises	Owned by Enterprises with: 1 to 20 Employees	20 to 99 Employees	100 to 499 Employees	500 to 749 Employees	750 to 999 Employees	1,000 to 1,499 Employees
334111	Electronic Computer Manufacturing	I	500	$31,748	0.03%	2.67%	0.31%	0.08%	NA	NA	NA
334413	Semiconductor and Related Device Manufacturing	I (Semis)	500	$31,748	0.05%	1.85%	0.36%	0.11%	0.07%	0.02%	0.03%
334413	Semiconductor and Related Device Manufacturing	I (Photovoltaics)	1,000	$8,777	0.01%	0.51%	0.10%	0.03%	0.02%	0.01%	0.01%
334119	Other Computer Peripheral Equipment Manufacturing	I (LCD)	500	$7,598	0.03%	0.43%	0.07%	0.02%	0.01%	0.02%	0.01%
334119	Other Computer Peripheral Equipment Manufacturing	I (MEMS)	500	$5,239	0.02%	0.30%	0.05%	0.01%	0.01%	0.01%	0.00%
325120	Industrial Gas Manufacturing	L	1,000	$151,045	1.28%	27.68%	0.92%	3.80%	NA	NA	NA
326140	Polystyrene Foam Product Manufacturing	OO	500	$3,364	0.03%	0.25%	0.06%	0.04%	NA	NA	0.01%
326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing	OO	500	$3,364	0.03%	0.19%	0.05%	0.02%	0.02%	NA	NA
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing	OO	750	$3,364	0.01%	0.22%	0.04%	0.01%	0.01%	0.01%	0.01%
335313	Switchgear and Switchboard Apparatus Manufacturing	OO	750	$3,364	0.02%	0.24%	0.05%	0.02%	NA	NA	NA
336391	Motor Vehicle Air-Conditioning Manufacturing	OO	750	$3,364	0.01%	0.33%	0.07%	NA	NA	NA	NA
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers	OO	100	$3,364	0.05%	0.10%	0.03%	0.03%	0.05%	0.03%	0.03%
423620	Electrical and Electronic Appliance, Television, and Radio Set Merchant Wholesalers	OO	100	$3,364	0.02%	0.07%	0.02%	0.01%	0.00%	0.01%	0.01%
423720	Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers	OO	100	$3,364	0.05%	0.10%	0.02%	0.03%	0.06%	0.03%	0.09%
423730	Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers	OO	100	$3,364	0.07%	0.13%	0.05%	0.06%	0.10%	0.03%	NA

423740	Refrigeration Equipment and Supplies Merchant Wholesalers	OO	100	$3,364	0.09%	0.16%	0.05%	0.10%	0.08%	0.04%	NA
443111	Household Appliance Stores	OO	$9 M	$3,364	0.24%	0.42%	0.09%	0.07%	NA	NA	NA
443112	Radio, Television and Other Electronics Stores	OO	$9 M	$3,364	0.14%	0.53%	0.15%	0.23%	NA	NA	NA
424610[b]	Plastics Materials and Basic Forms and Shapes Merchant Wholesalers	OO	100	$3,364	0.03%	0.09%	0.03%	0.02%	0.01%	0.01%	0.05%
33361	Engine, Turbine, and Power Transmission Equipment Manufacturing	SS	500 - 1,000	$2,213	0.00%	0.17%	0.03%	0.01%	0.01%	0.01%	0.01%
33531	Electrical Equipment Manufacturing	SS	750 - 1,000	$2,213	0.02%	0.19%	0.04%	0.01%	0.01%	0.00%	0.01%

[a] The Census Bureau defines an enterprise as a business organization consisting of one or more domestic establishments that were specified under common ownership or control. The enterprise and the establishment are the same for single-establishment firms. Each multi-establishment company forms one enterprise—the enterprise employment and annual payroll are summed from the associated establishments. Enterprise size designations are determined by the summed employment of all associated establishments.

Since the SBA's business size definitions (http://www.sba.gov/size) apply to an establishment's ultimate parent company, we assume in this analysis that the enterprise definition above is consistent with the concept of ultimate parent company that is typically used for Small Business Regulatory Enforcement Fairness Act (SBREFA) screening analyses.

Note: Receipt data in Table 5-7 has been adjusted to 2006$ using the latest GDP implicit price deflator reported by the U.S. Bureau of Economic Analysis (103.257/92.118=1.121) http://www.bea.gov/national/nipaweb/Index.asp (accessed December 21, 2009).

[b] The 2002 SUSB data uses 1997 NAICS codes. For this industry, the relevant code is NAICS 422610.

Table 5-14. Establishment Sales Tests by Industry and Enterprise[a] Size: Subsequent Years Costs

			SBA Size Standard (effective August 22, 2008)	Average Cost Per Entity ($/entity)	All Enter-prises	Owned by Enterprises with:					
2007 NAICS	NAICS Description	Sub-part				1 to 20 Employees[b]	20 to 99 Employees	100 to 499 Employees	500 to 749 Employees	750 to 999 Employees	1,000 to 1,499 Employees
334111	Electronic Computer Manufacturing	I	500	$31,748	0.03%	2.67%	0.31%	0.08%	NA	NA	NA
334413	Semiconductor and Related Device Manufacturing	I (Semis)	500	$31,748	0.05%	1.85%	0.36%	0.11%	0.07%	0.02%	0.03%
334413	Semiconductor and Related Device Manufacturing	I (Photovoltaics)	1,000	$8,777	0.01%	0.51%	0.10%	0.03%	0.02%	0.01%	0.01%
334119	Other Computer Peripheral Equipment Manufacturing	I (LCD)	500	$7,598	0.03%	0.43%	0.07%	0.02%	0.01%	0.02%	0.01%
334119	Other Computer Peripheral Equipment Manufacturing	I (MEMS)	500	$5,239	0.02%	0.30%	0.05%	0.01%	0.01%	0.01%	0.00%
325120	Industrial Gas Manufacturing	L	1,000	$19,109	0.16%	3.50%	0.12%	0.48%	NA	NA	NA
326140	Polystyrene Foam Product Manufacturing	OO	500	$2,933	0.02%	0.22%	0.05%	0.03%	NA	NA	0.01%
326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing	OO	500	$2,933	0.02%	0.16%	0.05%	0.02%	0.02%	NA	NA
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing	OO	750	$2,933	0.01%	0.19%	0.03%	0.01%	0.01%	0.01%	0.01%
335313	Switchgear and Switchboard Apparatus Manufacturing	OO	750	$2,933	0.02%	0.21%	0.04%	0.01%	NA	NA	NA
336391	Motor Vehicle Air-Conditioning Manufacturing	OO	750	$2,933	0.01%	0.29%	0.06%	NA	NA	NA	NA
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers	OO	100	$2,933	0.04%	0.09%	0.03%	0.03%	0.04%	0.02%	0.03%
423620	Electrical and Electronic Appliance, Television, and Radio Set Merchant Wholesalers	OO	100	$2,933	0.01%	0.06%	0.01%	0.00%	0.00%	0.01%	0.00%
423720	Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers	OO	100	$2,933	0.04%	0.09%	0.02%	0.03%	0.05%	0.02%	0.08%
423730	Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers	OO	100	$2,933	0.06%	0.12%	0.05%	0.05%	0.09%	0.03%	NA

423740	Refrigeration Equipment and Supplies Merchant Wholesalers	OO	100	$2,933	0.08%	0.14%	0.04%	0.09%	0.07%	0.04%	NA
443111	Household Appliance Stores	OO	$9 M	$2,933	0.21%	0.37%	0.08%	0.06%	NA	NA	NA
443112	Radio, Television and Other Electronics Stores	OO	$9 M	$2,933	0.12%	0.46%	0.13%	0.20%	NA	NA	NA
424610	Plastics Materials and Basic Forms and Shapes Merchant Wholesalers	OO	100	$2,933	0.03%	0.08%	0.02%	0.02%	0.01%	0.01%	0.04%
33361	Engine, Turbine, and Power Transmission Equipment Manufacturing	SS	500 - 1,000	$2,213	0.00%	0.17%	0.03%	0.01%	0.01%	0.01%	0.01%
33531	Electrical Equipment Manufacturing	SS	750 - 1,000	$2,213	0.02%	0.19%	0.04%	0.01%	0.01%	0.00%	0.01%

[a] The Census Bureau defines an enterprise as a business organization consisting of one or more domestic establishments that were specified under common ownership or control. The enterprise and the establishment are the same for single-establishment firms. Each multi-establishment company forms one enterprise—the enterprise employment and annual payroll are summed from the associated establishments. Enterprise size designations are determined by the summed employment of all associated establishments.

Since the SBA's business size definitions (http://www.sba.gov/size) apply to an establishment's ultimate parent company, we assume in this analysis that the enterprise definition above is consistent with the concept of ultimate parent company that is typically used for Small Business Regulatory Enforcement Fairness Act (SBREFA) screening analyses.

Note: Receipt data in Table 5-7 has been adjusted to 2006$ using the latest GDP implicit price deflator reported by the U.S. Bureau of Economic Analysis (103.257/92.118=1.121) http://www.bea.gov/national/nipaweb/Index.asp (accessed December 21, 2009).

[b] The 2002 SUSB data uses 1997 NAICS codes. For this industry, the relevant code is NAICS 422610.

5.3.1.3 Results of Screening Analysis

The Regulatory Flexibility Act generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute, unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small governmental jurisdictions, and small not-for-profit enterprises.

For the purposes of assessing the impacts of the rule on small entities, we defined a small entity as (1) a small business, as defined by SBA's regulations at 13 CFR Part 121.201; (2) a small governmental jurisdiction that is a government of a city, county, town, school district, or special district with a population of less than 50,000; or (3) a small organization that is any not-for-profit enterprise that is independently owned and operated and is not dominant in its field.

After considering the economic impact of the rule on small entities, EPA has concluded that this action will not have a significant economic impact on a substantial number of small entities. As shown in Tables 5-13 and 5-14, the average ratio of annualized reporting program costs to receipts of establishments owned by model small enterprises was less than 1% for industries presumed likely to have small businesses covered by the reporting program.

We acknowledge that several enterprise categories have ratios that exceed this threshold (e.g., enterprise with one to 20 employees). The Industrial Gas Manufacturing industry (NAICS 325120) has sales test results over 1% for all enterprises. The following enterprise categories have sales test results over 1% and for entities with less than 20 employees: Industrial Gas Manufacturing (325120) and Semiconductor and Related Device Manufacturing (334413).

Below we take a more detailed look at the categories noted above as having sales test ratios above 1%. EPA collected information on the entities likely to be covered by the rule as part of the expert sub-group process.

Threshold-based Analysis of Categories Having Sales Test Ratios Above 1%

Industrial Gas Manufacturing (325120)

Subpart L covers facilities included in NAICS codes for Industrial Gas Manufacturing (NAICS 325120). Within this subpart, EPA identified 13 ultimate parent company names covered by the proposed rule. Using publicly available sources (e.g., Hoovers.com), we collected parent company sales and employment data and found that only one company could be classified

as a small entity. Using the cost data for a representative entity (see Section 4), EPA determined the small entity's cost-to-sales ratio is below one percent.

Electronic Computer Manufacturing (334111) and Semiconductor and Related Device Manufacturing (334413)

Data on the number of electronics facilities comes from the World Fab Watch and the Flat Panel Display Fabs on Disk datasets. The census data categories cover more establishments than just those facilities covered in the rule. Subpart I covers facilities included in NAICS codes for Semiconductor and Related Device Manufacturing (334413) and Other Computer Peripheral Equipment Manufacturing (334119). The World Fab Watch dataset includes 216 facilities (94 of which exceed the 25,000 ton threshold), while the sum of the two NAICS codes include 1,903 establishments. Covered facilities with emissions greater than 25,000 MtCO2e per year are unlikely to be included in the 1 to 20 employees size category. Emissions are roughly proportional to production, and establishments with 1 to 20 employees total only 1.6% of total receipts, while the proposed threshold excludes 6% of industry emissions from the least-emitting facilities.

Although this rule would not have a significant economic impact on a substantial number of small entities, the Agency nonetheless tried to reduce the impact of this rule on small entities, including seeking input from a wide range of private- and public-sector stakeholders. When developing the rule, the Agency took special steps to ensure that the burdens imposed on small entities were minimal. The Agency conducted several meetings with industry trade associations to discuss regulatory options and the corresponding burden on industry, such as recordkeeping and reporting. The Agency investigated alternative thresholds and analyzed the marginal costs associated with requiring smaller entities with lower emissions to report. The Agency also selected a hybrid method for reporting, which provides flexibility to entities and helps minimize reporting costs.

SECTION 6
STATUTORY AND EXECUTIVE ORDER REVIEWS

This section describes EPA's compliance with several applicable executive orders and statutes during the development of the proposed F-GHG reporting rule, under subparts I, L, OO, and SS of the Mandatory Reporting Rule.

6.1 Executive Order 12866: Regulatory Planning and Review

Under Section 3(f)(1) of Executive Order 12866 (58 FR 51735, October 4, 1993), this action is not by itself an "economically significant regulatory action" because it is unlikely to have an annual economic effect of less than $100 million. EPA's cost analysis, presented in Section 4, estimates that for the minimum reporting under the recommended regulatory option, the total annualized cost of the rule will be approximately $6.1 million (in $2006) during the first year of the program and $3.9 million in subsequent years (including $0.4 million of programmatic costs to the Agency). However, this action adds Subparts I, L, OO, and SS to the mandatory GHG reporting rule, which was a significant regulatory action. Thus, EPA has chosen to analyze the impacts of Subparts I, L, OO, and SS as if their impacts were significant. EPA submitted this action to the Office of Management and Budget (OMB) for review under Executive Order 12866, and any changes made in response to OMB recommendations have been documented in the docket for this action.

In addition, EPA prepared this EIA, including an analysis of the potential costs associated with this action. In this report, EPA has identified the regulatory options considered, their costs, the emissions that would likely be reported under each option, and explained the selection of the option chosen for the rule. The costs of the rule are reported in Section 4, and the economic impacts and qualitative benefits assessment are reported in Section 5. Overall, EPA has concluded that the costs of the F-GHG Reporting Rule are outweighed by the potential benefits of more comprehensive information about CO_2 emissions.

6.2 Paperwork Reduction Act

The information collection requirements in this proposed rule have been submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq*. The Information Collection Request (ICR) document prepared by EPA has been assigned EPA ICR number [XXXX.XX].

EPA has identified the following goals of the mandatory GHG reporting system:

- Obtain data that is of sufficient quality that it can be used to analyze and inform the development of a range of future climate change policies and potential regulations.
- Balance the rule's coverage to maximize the amount of emissions reported while excluding small emitters.
- Create reporting requirements that are, to the extent possible and appropriate, consistent with existing GHG reporting programs in order to reduce reporting burden for all parties involved.

The information from F-GHG facilities will allow EPA to make well-informed decisions about whether and how to use the CAA to regulate these facilities and encourage voluntary reductions. Because EPA does not yet know the specific policies that will be adopted, the data reported through the mandatory reporting system should be of sufficient quality to inform policy and program development. Also, consistent with the Appropriations Act, the reporting rule covers a broad range of sectors of the economy.

This information collection is mandatory and will be carried out under CAA Sections 114. Information identified and marked as Confidential Business Information (CBI) will not be disclosed except in accordance with procedures set forth in 40 CFR Part 2. However, emissions information collected under CAA Sections 114 generally cannot be claimed as CBI and will be made public.[15]

The projected cost and hour respondent burden in the ICR, averaged over the first three years after promulgation, is $4.51 million and 81,500 hours per year. The estimated average burden per response is 272 hours; the frequency of response is annual for all respondents that must comply with the rule's reporting requirements; and the estimated average number of likely respondents per year is 276. The cost burden to respondents resulting from the collection of information includes the total capital and start-up cost annualized over the equipment's expected useful life (averaging $44,000 per year) a total operation and maintenance component (averaging $24,000 per year), and a labor cost component (averaging $4.44 million per year). Burden is defined at 5 CFR Part 1320.3(b).

[15] Although CBI determinations are usually made on a case-by-case basis, EPA has issued guidance in an earlier Federal Register notice on what constitutes emissions data that cannot be considered CBI (956 FR 7042 – 7043, February 21, 1991). As discussed in Section II.R of the preamble to the rule, EPA will be initiating a separate notice and comment process to make CBI determinations for the data collected under this proposed rulemaking.

These cost numbers differ from those shown elsewhere in the EIA because ICR costs represent the average cost over the first three years of the rule, but costs are reported elsewhere in the EIA for the first year of the rule. Also, the total cost estimate of the rule in the EIA includes the cost to the Agency to administer the program. The ICR differentiates between respondent burden and cost to the Agency, estimated to be $384,000.

An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations in 40 CFR are listed in 40 CFR Part 9. When this ICR is approved by OMB, the Agency will publish a technical amendment to 40 CFR part 9 in the Federal Register to display the OMB control number for the approved information collection requirements contained in the final rule.

6.3 Regulatory Flexibility Act

The Regulatory Flexibility Act generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute, unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small governmental jurisdictions, and small not-for-profit enterprises.

The first step in this assessment was to determine whether the rule will have a significant impact on a substantial number of small entities (SISNOSE). To make this determination, EPA used a screening analysis that allows us to indicate whether EPA can certify the rule as not having a SISNOSE. The elements of this analysis included

- identifying affected sectors and entities,
- selecting and describing the measures and economic impact thresholds used in the analysis, and
- determining SISNOSE certification category.

6.3.1 Identify Affected Sectors and Entities

For the purposes of assessing the impacts of the rule on small entities, we defined a small entity as (1) a small business, as defined by SBA's regulations at 13 CFR Part 121.201; (2) a small governmental jurisdiction that is a government of a city, county, town, school district, or special district with a population of less than 50,000; or (3) a small organization that is any not-for-profit enterprise that is independently owned and operated and is not dominant in its field.

For the F-GHG Reporting Rule, small entity is defined as a small business as defined by the Small Business Administration's regulations at 13 CFR 121.201; according to these size standards, criteria for determining if ultimate parent companies owning affected facilities are categorized as small vary by NAICS. Small entity criteria range from total number of employees at the firm fewer than 100 to number of employees fewer than 1000; one affected NAICS, 44311, defines small entities as those with sales below $9 million. Tables 5-6 and 5-7 present small business criteria and enterprise size distribution data for affected NAICS.

6.3.2 Develop Small Entity Economic Impact Measures

The ratio of total annualized compliance costs to firm sales (or sales test) is the selected impact measure. Details are provided in section 5.3, and results are presented in Table 5-8 for first-year costs and in Table 5-9 for subsequent year costs. These sales tests examine the average establishment's total annualized mandatory reporting costs to the average establishment receipts for enterprises within several employment categories[16]. The average entity costs used to compute the sales test are the same across all of these enterprise size categories. As a result, the sales-test will overstate the cost-to-receipt ratio for establishments owned by small businesses, because the reporting costs are likely lower than average entity estimates provided by the engineering cost analysis

6.3.3 Results of Screening Analysis

After considering the economic impact of the rule on small entities, EPA has concluded that this action will not have a significant economic impact on a substantial number of small entities. As shown in Table 5-8, the average ratio of annualized reporting program costs to revenues for F-GHG firms owned by model small enterprises and likely to be affected by the proposed rule was generally less than 1%. For two NAICS, however, some size categories (especially those with 1-20 employees) show costs exceeding 1% of sales. These sectors are Industrial Gas Manufacturing (NAICS 325120) and Semiconductor and Related Device Manufacturing (NAICS 334413). A more careful examination of impacts on small firms in these NAICS codes was conducted.

Analysis of firms in NAICS 334413 shows that firms with fewer than 20 employees produce less than 2% of output; firms below the 25,000 Mt CO_2e threshold release approximately 6% of emissions. Because emissions and production levels are highly correlated, firms fewer than 20 employees are generally not expected to be affected by the proposed rule; if

[16]For the one to 20 employee category, we exclude SUSB data for enterprises with zero employees. These enterprises did not operate the entire year.

they are, their costs are likely to be lower than the overall average costs used in the screening analysis. Thus, EPA does not expect the proposed rule to impose significant costs to a substantial number of small entities in NAICS 334413.

Subpart L covers facilities included in NAICS codes for Industrial Gas Manufacturing (NAICS 325120). Within this subpart, EPA identified 13 ultimate parent company names covered by the proposed rule. Using publicly available sources (e.g., Hoovers.com), we collected parent company sales and employment data and found that only one company could be classified as a small entity. Using the cost data for a representative entity (see Section 4 of the EA), EPA determined the small entity's cost-to-sales ratio is below one percent.

Although this rule would not have a significant economic impact on a substantial number of small entities, the Agency nonetheless tried to reduce the impact of this rule on small entities, including seeking input from a wide range of private- and public-sector stakeholders. When developing the rule, the Agency took special steps to ensure that the burdens imposed on small entities were minimal. The Agency conducted several meetings with industry trade associations to discuss regulatory options and the corresponding burden on industry, such as recordkeeping and reporting. The Agency investigated alternative thresholds and analyzed the marginal costs associated with requiring smaller entities with lower emissions to report. The Agency also selected a hybrid method for reporting, which provides flexibility to entities and helps minimize reporting costs.

In addition to the public hearing that EPA plans to hold, EPA has an open door policy, similar to the outreach conducted during the development of the proposed and final Mandatory GHG Reporting Rule. Details of these meetings are available in the docket (EPA-HQ-OAR-2008-0508).

6.4 Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), P.L. 104-4, establishes requirements for federal agencies to assess the effects of their regulatory actions on state, local, and tribal governments and the private sector. Under Section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for final rules with “federal mandates” that may result in expenditures to state, local, and tribal governments, in the aggregate, or to the private sector, of $100 million or more in any one year.

This proposed rule does not contain a Federal mandate that may result in expenditures of $100 million or more for State, local, and tribal governments, in the aggregate, or the private

sector in any one year. Overall, EPA estimates that the total annualized costs of this proposed rule are approximately $6.1 million for the first year, and $3.9 million for subsequent years ($2006). Thus, this proposed rule is not subject to the requirements of sections 202 or 205 of UMRA.

This proposed rule is also not subject to the requirements of section 203 of UMRA because it contains no regulatory requirements that might significantly or uniquely affect small governments. Facilities subject to the proposed rule include manufacturers, wholesalers, and retailers. None of the facilities currently known to undertake these activities are owned by small governments.

6.5 Executive Order 13132: Federalism

Executive Order 13132, entitled "Federalism" (64 FR 43255, August 10, 1999), requires EPA to develop an accountable process to ensure "meaningful and timely input by state and local officials in the development of regulatory policies that have federalism implications." "Policies that have federalism implications" is defined in the executive order to include regulations that have "substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government."

This proposed rule does not have federalism implications. It will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132.

This regulation applies to manufacturers, wholesalers, and retailers. Few government facilities would be affected. This regulation also does not limit the power of states or localities to collect GHG data and/or regulate GHG emissions. Thus, Executive Order 13132 does not apply to this proposed rule.

In the spirit of Executive Order 13132, and consistent with EPA policy to promote communications between EPA and State and local governments, EPA specifically solicits comment on this proposed action from State and local officials.

6.6 Executive Order 13175: Consultation and Coordination with Indian Tribal Governments

Executive Order 13175, entitled "Consultation and Coordination with Indian Tribal Governments" (59 FR 22951, November 6, 2000), requires EPA to develop an accountable

process to ensure "meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications."

This proposed rule is not expected to have tribal implications, as specified in Executive Order 13175. This regulation applies to facilities that directly emit GHGs. Few facilities expected to be affected by the rule are likely to be owned by tribal governments. Thus, Executive Order 13175 does not apply to this proposed rule.

Although Executive Order 13175 does not apply to this proposed rule, EPA sought opportunities to provide information to tribal governments and representatives during development of the MRR rule. In consultation with EPA's American Indian Environment Office, EPA's outreach plan for the MRR included tribes. For a complete list of tribal contacts, see the "Summary of EPA Outreach Activities for Developing the Greenhouse Gas Reporting Rule," in the Docket for this proposed rulemaking (EPA-HQ-OAR-2008-0508-055). In addition to the consultation activities supporting the MRR, EPA continues to provide information to tribal governments and representatives during development of the Track II rules such as this proposed rulemaking. EPA specifically solicits additional comment on this proposed action from tribal officials.

6.7 Executive Order 13045: Protection of Children from Environmental Health and Safety Risks

EPA interprets Executive Order 13045 (62 F.R. 19885, April 23, 1997) as applying only to those regulatory actions that concern health or safety risks, such that the analysis required under Section 5-501 of the executive order has the potential to influence the regulation. This action is not subject to Executive Order 13045 because it does not establish an environmental standard intended to mitigate health or safety risks.

6.8 Executive Order 13211: Actions that Significantly Affect Energy Supply, Distribution, or Use

This proposed rule is not a "significant energy action" as defined in Executive Order 13211 (66 FR 28355, May 22, 2001) because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy. Further, we have concluded that this proposed rule is not likely to have any adverse energy effects.

This proposal relates to monitoring, reporting, and recordkeeping at facilities that manufacture, sell, import, or export F-GHG related products; it does not adversely affect energy

supply, distribution or use. Therefore, we conclude that this proposed rule is not likely to have any adverse effects on energy supply, distribution, or use.

6.9 National Technology Transfer Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 (NTTAA), Public Law No. 104-113 (15 U.S.C. 272 note) directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies. NTTAA directs EPA to provide Congress, through OMB, with explanations when the Agency decides not to use available and applicable voluntary consensus standards.

This proposed rulemaking involves technical standards. EPA proposes to use voluntary consensus standards from three different voluntary consensus standards bodies: American Society for Testing and Material (ASTM), American Society of Mechanical Engineers (ASME), and International SEMATECH Manufacturing Initiative. These voluntary consensus standards will help facilities monitor, report, and keep records of F-GHG emissions associated with their manufacturing or sales activities. No new test methods were developed for this proposed rule. Instead, from existing rules for source categories and voluntary GHG programs, EPA identified existing means of monitoring, reporting, and keeping records. The existing methods (voluntary consensus standards) include a broad range of measurement techniques, methods to measure gas or liquid flow, and methods to gauge and measure petroleum and petroleum products. The test methods are incorporated by reference into the rule and are available as specified in Section 98.6 of subpart A.

By incorporating voluntary consensus standards into this proposed rule, EPA is both meeting the requirements of the NTTAA and presenting multiple options and flexibility for complying with the proposed rule. EPA welcomes comments on this aspect of the proposed rulemaking and, specifically, invites the public to identify potentially-applicable voluntary consensus standards and to explain why such standards should be used in this proposed regulation.

6.10 Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order 12898 (59 FR 7629, February 16, 1994) establishes federal executive policy on environmental justice. Its main provision directs federal agencies, to the greatest extent

practicable and permitted by law, to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States.

EPA has determined that this proposed rule will not have disproportionately high and adverse human health or environmental effects on minority or low-income populations because it does not affect the level of protection provided to human health or the environment. This proposed rule does not affect the level of protection provided to human health or the environment because it is a rule addressing information collection and reporting procedures.

SECTION 7
CONCLUSIONS

The supplemental proposal requires reporting of fluorinated greenhouse gas (F-GHG) emissions from electronics manufacturing, production of fluorinated gases, and use of electrical equipment. EPA is also proposing to require such reporting from manufacturers of electrical equipment, import and export of pre-charged equipment, and closed cell foams. These F-GHG source categories are covered under Subparts I, L, OO, and SS of the rule.

7.1 Summary of Sectors Covered

7.1.1 Subpart I – Electronics Manufacturing

Electronics manufacturing includes, but is not limited to, the manufacture of semiconductors, liquid crystal displays (LCDs), microelectricomechanical (MEMS), and photovoltaic cells (PV). The electronics industry uses multiple long-lived F-GHGs such as perfluorocarbons (PFCs), Hydrofluorocarbons (HFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3), as well as nitrous oxide (N_2O). This proposed rule would apply to electronics manufacturing facilities that emit equal to or greater than 25,000 metric tons of CO_2e per year[17] from electronics manufacturing processes such as plasma etching, thin film deposition, chamber cleaning, and heat transfer fluid use. EPA is also proposing methods to estimate emissions from cleaning and etch processes for semiconductor, LCD, MEMS, and PV manufacture and also methods for estimating N_2O emissions from deposition and other manufacturing processes such as chamber cleaning. EPA is also clarifying methods for estimating emissions from heat transfer fluids. Finally, EPA is proposing methods for verifying destruction or removal efficiency (DRE) from abatement equipment.

7.1.2 Subpart L – Fluorinated GHG Producers

Affected entities under subpart L are defined as any facility that produces a fluorinated gas from any raw material or feedstock chemical. Fluorinated gas production includes the production of fluorinated GHG, CFC, or HCFC. EPA stipulates that production of fluorinated

[17] As discussed further below, EPA is proposing that uncontrolled emissions be used for purposes of determining whether a facility's emissions are equal to or greater than 25,000 mtCO2e.

gases does not include the reuse or recycling of fluorinated GHG or the generation of HFC-23 during the production of HCFC-22.

Facilities that produce fluorinated gases will be required to report their fluorinated GHG emissions from fluorinated gas production, transformation, and destruction, as well as combustion-related CO_2, CH_4, and nitrous oxide (N_2O) emissions from stationary fuel combustion. Fluorinated gases include fluorinated GHGs (HFCs, PFCs, SF6, NF3, HFEs, etc.), CFCs, and HCFCs. However, emissions of HFC-23 from HCFC-22 production are addressed under subpart O and are therefore excluded from this subpart. Similarly, emissions of CFCs and HCFCs are addressed under the regulations implementing Title VI of the Clean Air Act and are therefore excluded from this subpart.

7.1.3 Subpart OO – Importing/Exporting of Pre-charged Equipment and Foams

Affected entities under subpart OO are defined as any entity that is an importer and/or exporter of pre-charged equipment or closed-cell foams that contain fluorinated GHGs. A variety of products containing fluorinated greenhouse gases (F-GHGs), nitrous oxide (N_2O), and carbon dioxide (CO_2) are imported into and exported from the United States. Pre-charged equipment includes air-conditioning, refrigeration, and electrical equipment. Closed-cell foams that are imported and exported include polyurethane (PU) rigid foam used in insulation in domestic refrigerators and freezers,; commercial refrigeration foam,; PU rigid sandwich panel continuous and discontinuous foam; extruded polystryrene (XPS) sheet foam; and XPS boardstock foam.

EPA is proposing to require reporting of these imports and exports. Importers and exporters of pre-charged equipment and closed-cell foams would be subject to requirements similar to those for importers and exporters of bulk GHGs. In addition, equipment importers would be required to report the types and charge sizes of equipment and the number of pieces of each type of equipment that they imported or exported, while foam importers would be required to report the volume of foam and F-GHG density of the foam that they imported. As is true for importers and exporters of bulk F-GHGs, importers and exporters of equipment and foam would only be required to report if their total imports or exports exceeded the 25,000 mtCO2e threshold.

7.1.4 Subpart SS – Electrical Equipment and Components Manufacturing

Affected entities under subpart SS are defined as electrical equipment manufacturers and refurbishers of SF_6-insulated closed-pressure system equipment and sealed-pressure system equipment including gas-insulated substations, circuit breakers, other switchgear, gas-insulated lines, or power transformers containing sulfur-hexafluoride (SF_6) or perfluorocarbons (PFCs). EPA is proposing to require reporting of SF6 and PFC emission from electrical equipment manufacturing and refurbishing using a mass-balance monitoring method comparable to the approach specified for subpart DD, *Sulfur Hexafluoride (SF6) and Perfluorocarbons (PFCs) from Electrical Equipment at an Electric Power System.*

Facilities covered under subpart SS would be required report annual emission report all SF_6 and PFC emissions, including those from equipment testing, equipment manufacturing, and bulk SF_6 and PFC handling. In addition, electrical equipment manufacturers would be required to submit supplemental data that includes: SF_6 and PFCs with or inside equipment delivered to customers, SF_6 and PFCs returned by customers with or inside equipment, bulk SF_6 and PFC purchases, SF_6 and PFCs sent off-site for destruction or to be recycled, SF_6 and PFC returned from offsite after recycling, SF_6 and PFCs stored in containers at the beginning and end of the year, SF_6 and PFCs returned to suppliers. If applicable, facilities would also be required to report combustion-related CO_2, CH_4, and nitrous oxide (N_2O) emissions from stationary fuel combustion. EPA would only require emission reporting a facility's total annual purchases of SF_6 and PFCs are greater than 23,000 lbs. This reporting threshold is equivalent an emissions-based threshold of 25,000 $MtCO_2e$, assuming an average manufacturer emission rate of 10%.

7.2 Estimated Costs and Impacts of the Mandatory GHG Reporting Program

The total national costs for the selected option are estimated to be $6.1 million in the first year and $3.9 million in subsequent years ($2006). This includes a public sector burden estimate of $384,000 for program implementation and verification activities. Subparts bearing the greatest share of the ongoing private costs of the rule are fluorinated gas producers (60%), and electronics industry (36%). The average ongoing (subsequent year) private cost per metric ton varies by subpart; measures range from less than $0.01 per ton (Subpart SS) to $0.45 per ton (Subpart I). The ongoing national cost estimates increase by approximately $1.5 million per year if the 23 large electronics facilities that participate in EPA's PFC Reduction/Climate Partnership for the Semiconductor Industry use abatement devices and incur costs for verifying the DREs of these devices. The national costs are distributed to several economic sectors and represent approximately less than 0.01% of 2008 gross domestic product; overall, EPA does not believe

the rule will have a significant macroeconomic impact on the national economy or on small entities within those sectors.

SECTION 8
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